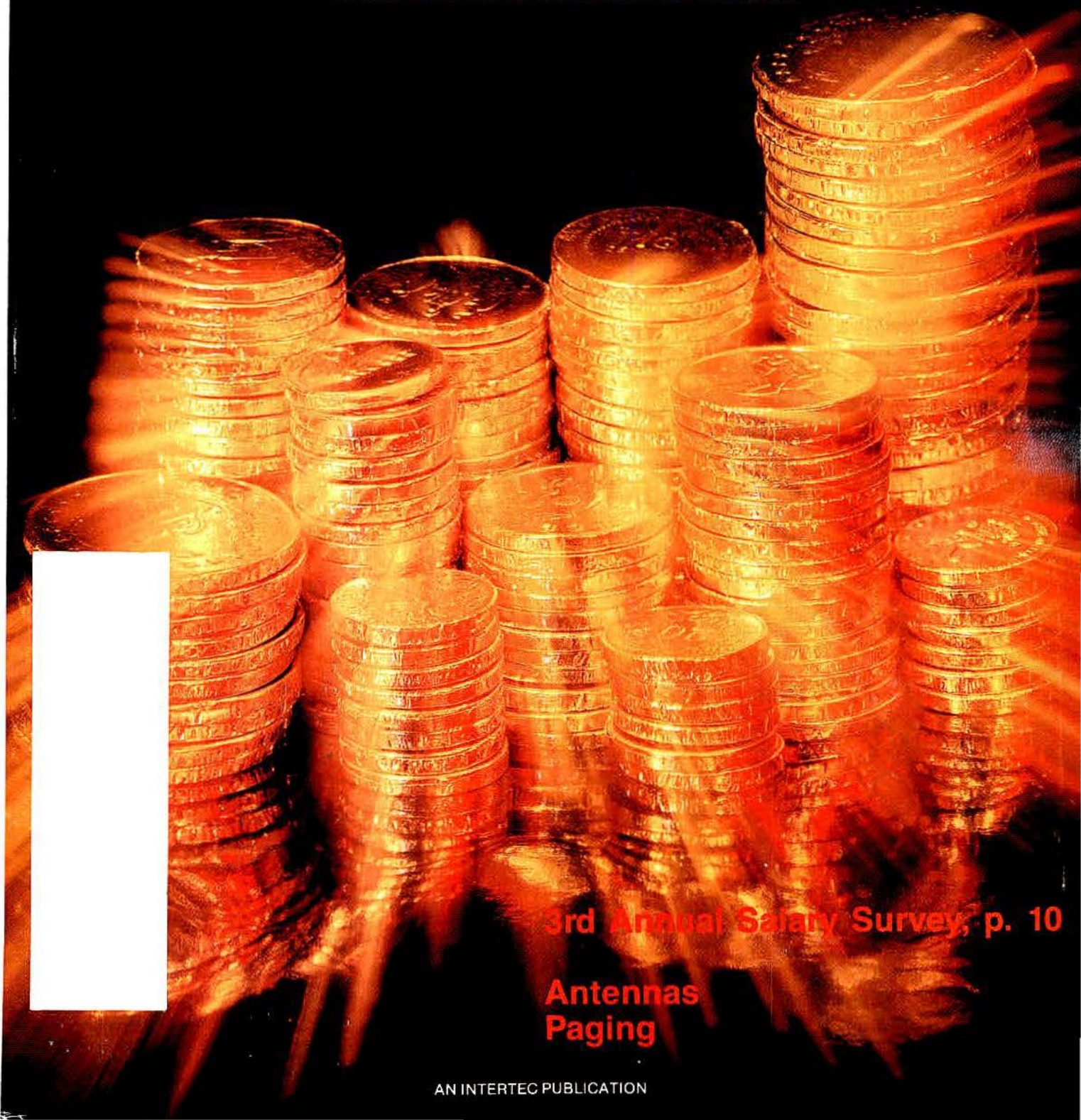


September 1989/\$3.00

# Mobile Radio Technology

The journal of mobile communications technology



3rd Annual Salary Survey, p. 10

Antennas  
Paging

AN INTERTEC PUBLICATION





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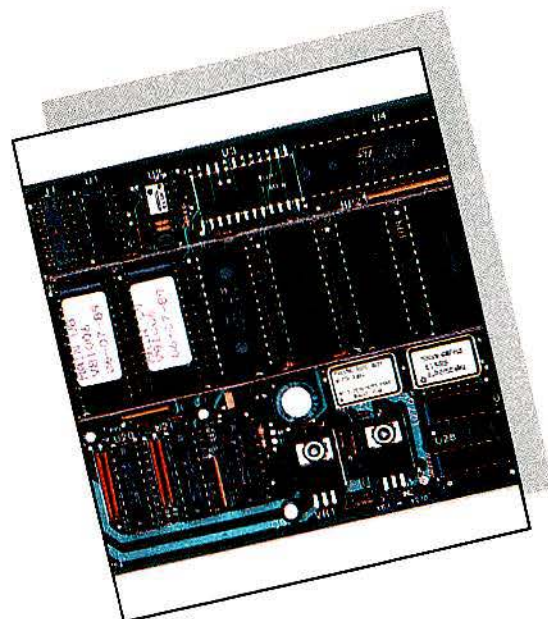
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How does your salary rate?



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**On the cover:** *MRT's* Third Annual Salary Survey on page 10 allows you to compare your earnings with your peers.

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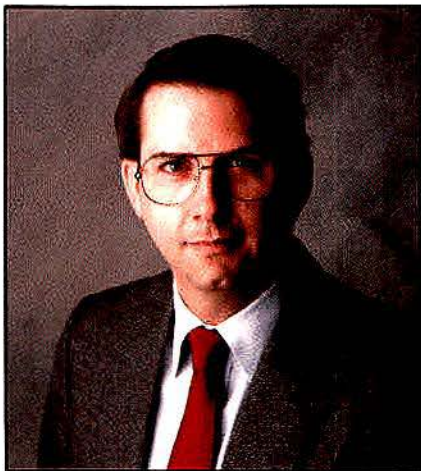
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## Scanning . . .

### And then there were two?

The Senate's "punishment" of the FCC—stemming principally from its broadcast regulatory actions—continues to leave the commission with three members out of an authorized strength of five. The Senate held no hearings to confirm two nominees submitted by former president Reagan more than a year ago.

President Bush did not hurry to nominate replacements, either. He waited until six months of his own term elapsed before sending names to the Senate.

Now the possibility exists that Patricia Diaz Dennis may exit, her term having expired June 30. Dennis is said to be "keeping her options open." If she leaves, the FCC cannot make decisions that require a vote. With only two members, it will lack a quorum. Under law, she may remain as long as one year without renomination and reconfirmation. Dennis, a Democrat, remains at the FCC as of this writing.

The president's three nominees, Alfred Sikes for chairman and Sherri Marshall and Andrew Barrett as commissioners, are Republicans. To maintain the partisan ratio required by law, his next nomination must not be a Republican.

Sikes and Marshall have federal experience that will help them come up to speed regarding FCC matters. Nevertheless, we will see three and perhaps as many as four new faces on a five-member commission, a situation not likely to mean quick decisions on pend-

ing land mobile radio matters.

In the interim, Dennis *might* depart, stalling decisions altogether. Among them are approvals for regional public safety plans that trigger the release of urgently needed 800MHz frequencies.

It is deplorable to see government standing in the way of communication system development. The Senate is not punishing the FCC. The Senate is punishing residents of the United States who may suffer from delays in the approval of communication systems that support life safety, the protection of property and the conduct of business. Keep that in mind, won't you?

### Meteor-scatter, revisited

In July, we made our third visit to a Missouri farm where Transtrack is building a base station for meteor-scatter communications. (See photo on this page and "Tracking 64,000 Vehicles With Meteor-Scatter Radio," January 1989 *MRT*.)

This time, instead of an empty field, we found an equipment shelter and four towers topped with antennas. A nearby utility pole bears the ac power main

switch. The switch position was "off," so the site was not active.

But it is clear that the *race is on*.

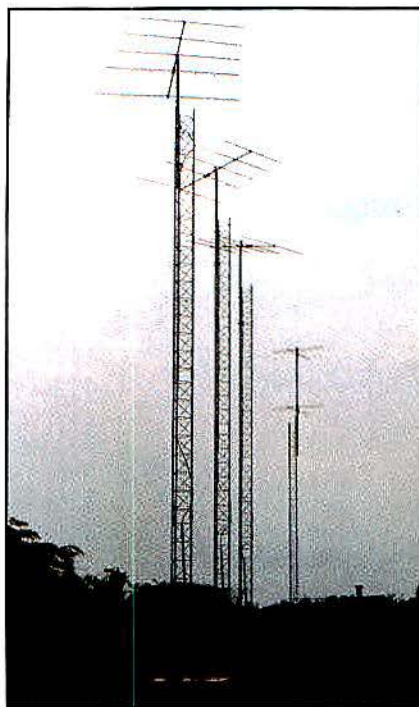
Several technologies racing to capture lucrative long-haul truck communications and position location contracts are:

- meteor-scatter propagation.
- geostationary orbital satellites.
- terrestrial specialized mobile radio networks.

Development once was hush-hush. With a few companies, it still is. But now system operators send flurries of press releases whenever a trucking company selects their service. They want to create a "bandwagon" effect that draws more and more customers.

It draws *us* back to Missouri to watch a unique technology unfold.

—Don Bishop



Four towers support yagi receiving antennas and turnstile folded dipole transmitting antennas at a remote base station in Missouri. The meteor-scatter communications facility is operated by Transtrack, Marion, MA.



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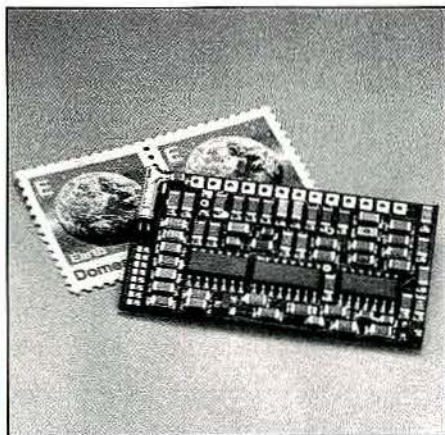
"Perfect...on demonstrations the scramblers sell themselves...real high quality...." (Dealer in Kentucky)

"Working very well...now every police officer wants the extra security...a real nice security addition to our system...." (Police Department in Kansas)

"Nothing but good and great things to say...they work beautifully...we'd love to tell others about them...they're great!" (Police Department in Washington state)

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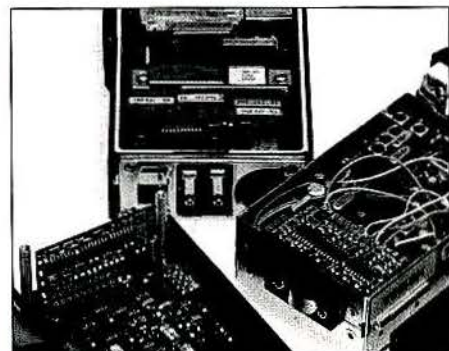
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## For circuit boards:

In the June issue's "Letters" column, Klaus Spies asks for non-chlorofluoro-carbon flux solvents and circuit coolers.

I recommend ethanol (pure grain alcohol) and a toothbrush for cleaning boards. Find a "mustard dispenser" squeeze bottle and make a tiny pinhole in its tip for squirting the ethanol.

For freeze spray, I suspect that carbon dioxide (pellet gun) cartridges may be fitted into the tiny oxy-butane brazing torches sold by Radio Shack and others, allowing one to chill components in an effort to find intermittents. The hot tip of a soldering iron works to ferret out thermal-related intermittents.

Ron Johnson  
Austin, TX

## Service manuals:

I am looking for service manuals for Livermore Data models LCP-1010, LCP 2020, LCP 2080 and LCP 4080 mobile

telephones. Possibly an *MRT* reader may have these or know where I can find them; the manufacturer no longer is in business.

Geoff Fors  
769 Pacific St.  
Monterey, CA 93940

## Field strength:

"Paging Coverage vs. Frequency" (June 1989) is a good article. But it contains one big mistake.

In Figure 1, and the text relating to it, the authors claim that if a signal at a particular free-space distance from the transmitter has a field strength of  $100\mu\text{V/m}$ , then the signal at twice the distance will have a value of  $25\mu\text{V/m}$ .

Not true. The emitted energy is power; it is composed of both voltage and current. Thus, with field strength inversely proportional to the square of the distance from the source ( $1/4$  at twice the distance), field strength is a meas-

urement of field power, not voltage.

For example, half the voltage times half the current equals one-fourth the power, a 6dB loss.

Therefore, the voltage field strength is  $50\mu\text{V/m}$  at the distance indicated by the diagram, not  $25\mu\text{V/m}$ .

Stephen R. Weber Jr.  
Fresno, CA

Correct!—DB

## Fast Fact Card comments:

The most interesting article in the March issue was "Modify Code 3 Equipment For Public Safety Use."

Among the toughest problems encountered on the job are obtaining good-quality replacement parts at reasonable prices and pinpointing defective high-frequency inductors in circuits.

Michael S. Sage  
Radio Technician  
Charlotte, NC

## Mobile Radio Technology

The journal of mobile communications technology

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## Letters to the editor

I like the specific problem-solving or applications of technology articles, such as "Radio Modems Replace Leased Lines" by Judi Kanne and "Modify Code 3 Equipment For Public Safety Use" by B.A. "Duke" Ducote in the March issue.

The most interesting article in the issue was "When To Use Strobes On Communications Towers" by the

editorial director.

The most difficult problem on the job is providing "star wars" communications on a small budget and within regulatory guidelines.

James Crate  
Communications Supervisor  
Shell Oil  
Deer Park, TX

The most interesting article in the May issue was "Performance Testing For Base Remote Control" by Harold Kinley, CET.

The toughest problems on the job are:  
(1) keeping up with the rapid advancements in technology and their applications.

(2) Finding, hiring and keeping competent technicians.

Robert A. Fay  
President  
Police Emergency Radio Services  
Framingham, MA

A fine magazine for the trade. I would encourage you to print more "hands-on" articles, such as "Performance Testing For Base Remote Control" by Harold Kinley, CET, in the May issue.

"What's the Range of My Pager" in the same issue was informative.

John B. McMahon II  
U.S. Coast Guard  
Elizabeth City, NC

The magazine always is interesting, informative and a pleasure to read.

All of the February issue's fiber optic articles were interesting. But "Replace Coaxial Cable With Optical Fiber" may have the most promising idea.

The two toughest problems faced on the job are:

- *Time*—Balancing customer needs and responses with the shop workload.
- *Experienced technicians*—Finding top-quality people for an expanding service shop.

Joe Evans  
Manager  
Clackamas Communications  
Eugene, OR

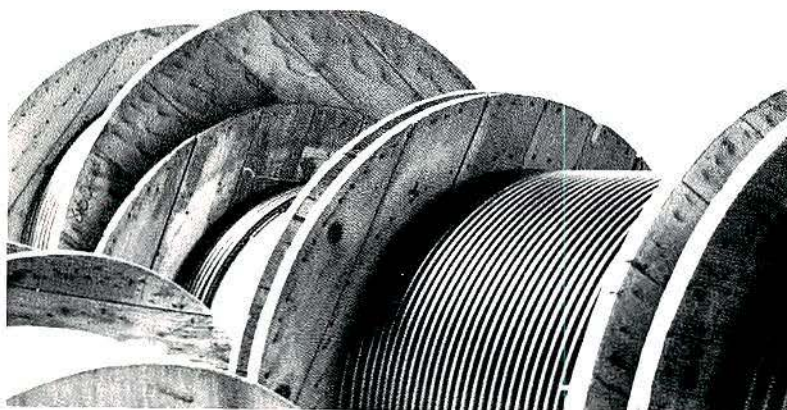
The May 1989 issue was a good issue, as usual. I enjoy articles that cover the basics that often are taken for granted.

I especially liked "Base Remote Control Performance Testing" by Harold Kinley, CET.

One thing more: It is difficult to remember all the abbreviations used in magazines.

Charles L. Kelsey  
Kelsey Communications  
Mayville, NY

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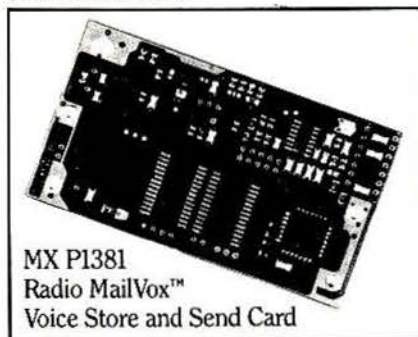
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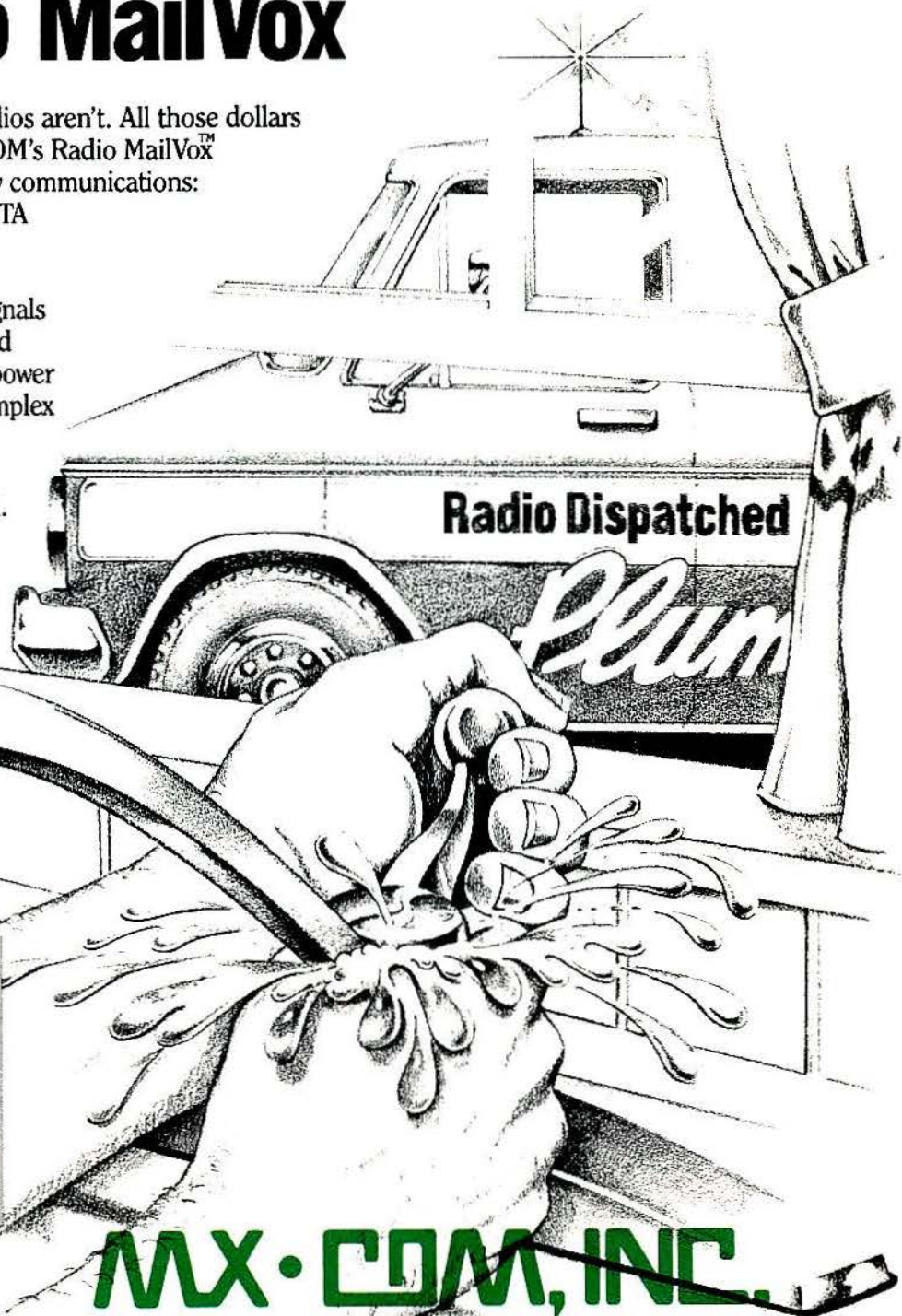
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---

# 1989 Salary Survey

*Median salaries for technical, corporate and operations staffs have escalated since last year. The median 'percentage of increase' for all staff types rose as well. This report indicates certified technicians reap higher earnings.*



---

**By Jane Bryant**  
**Staff Editor**

---

The mobile radio professional salary news this year is sweet for technical, corporate and operations staffs alike, where the group median salaries have increased since last year. Regarding median salaries, the report reveals those with certified technical competency and holders of an FCC license command higher pay than non-certified individuals, demonstrating the growing

importance of certified technical competency. This and other information presented in this year's survey will help you to compare your salary with your peers.

## **The study**

Survey information is broken into three staff profiles of those in the mobile radio field: corporate staff, operations staff and technical staff as shown in Tables 1, 2 and 3 on the following pages. For a guide to title classifications under

each staff profile group, refer to the listings under the respective groups on the subscription card on page 129.

Within the tabular staff profiles, categories include:

- salary level.
- salary increase received during the past year.
- fringe benefits.
- years in present job.
- years in mobile radio industry.
- education.
- age.



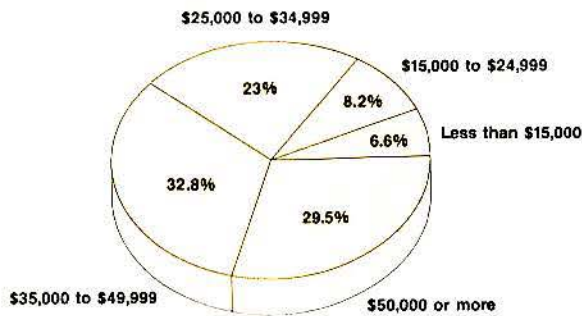


Figure 1. Percentages of respondents in salary ranges for corporate staff.

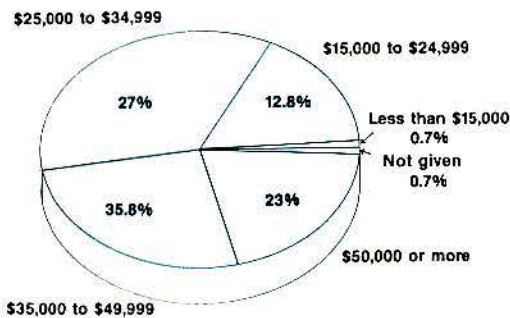


Figure 2. Percentages of respondents in salary ranges for operations staff.

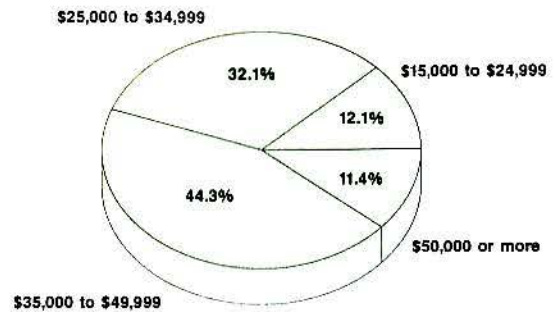


Figure 3. Percentages of respondents in salary ranges for technical staff.

Breakdowns within the tables for each staff profile type encompass dealers, public safety, business and industry, transportation and service-providers segments.

Median salaries are given for the subgroups as well as total median salaries for each staff profile group. Because the tables report *median* salaries, these figures may be quite different from average salaries. The median salary is the midpoint for the group represented. Half of the group has a higher salary, and half of the group has a lower salary than the median value. The median value provides a better statistical representation of the overall data and is used throughout this article.

It should be noted that a relatively small incidence rate of business and industrial radio users and transportation radio user corporate staffs exist. Therefore, Table 1 on page 12 excludes individual statistics for these subgroups under corporate staff profile results but includes their responses in the total column.

The median salaries for the three staff

profile groups are summarized in Table 4 on page 18. As shown in Table 4, the median salary for corporate staff is the highest median salary in mobile radio at \$41,000. Those involved in operations have the next highest median salary, which is \$38,950, and the technical median salary is the lowest at \$37,050.

A breakdown comparing 1989 earnings by percentages in each profile segment is shown in Figures 1, 2 and 3 above. Across all three classifications, the majority of the respondents list fringe benefits such as medical insurance, paid vacation and paid sick leave as standard.

#### 1988 vs. 1989

Figure 4 on page 20 further expands the median salary information by comparing 1988 median salaries with those of 1989. Breakdowns of the three staff profiles within the industry segments are illustrated in the figure.

As shown in Figure 4, median salaries have increased since last year for technical, corporate and operations staffs. The corporate staff encountered

the healthiest median increase over last year, with this year's median salary of \$41,000, an increase of \$4,800.

Technical staff realized a \$2,100 median salary increase over last year, with this year's median tabulated at \$37,050.

The median salary in operations went up slightly from last year at \$38,950, an increase of \$500.

The largest median salary by subgroup in the corporate staff is \$43,350 in the dealer segment. In the technical staff, \$41,350 is the largest median salary by subgroup in the transportation segment.

By far the largest median salary by subgroup across all three profiles is \$48,500 for business and industrial radio users in the operations segment.

Compensation variances occur from year to year, with the most drastic median salary decrease encountered in the corporate staff service-providers subgroup. The median salary in this segment plummeted \$4,500 from 1988 to 1989, standing at \$38,000 in 1989.

Another significant median salary drop appears in the public safety



# SNAP ON

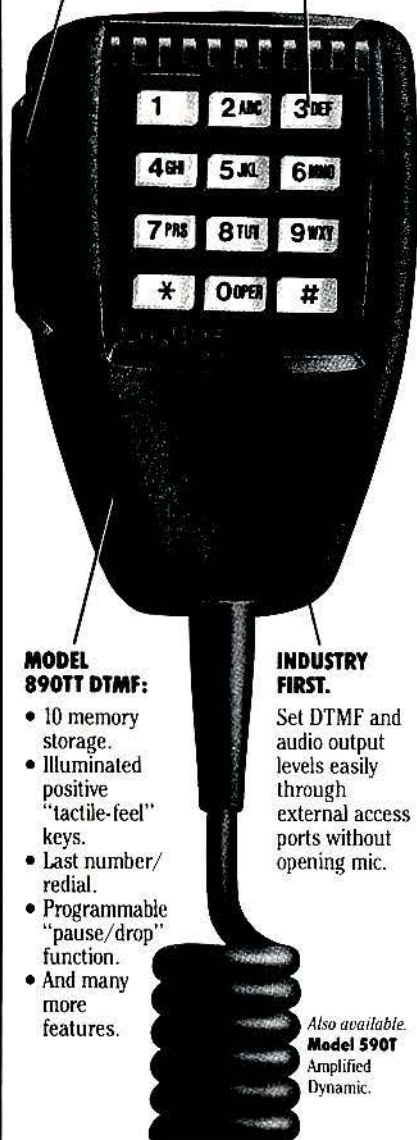
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TABLE 1 — CORPORATE STAFF PROFILE\*

	Total %	Dealers %	Public Safety %	Service Providers %
<b>Salary Level</b>				
Less than \$15,000	6.6	—	25.0	11.8
\$15,000 to \$24,999	8.2	4.0	12.5	5.9
\$25,000 to \$34,999	23.0	28.0	25.0	29.4
\$35,000 to \$49,999	32.8	36.0	37.5	29.4
\$50,000 or more	29.5	32.0	—	23.5
No answer	—	—	—	—
Median =	\$41,000	\$43,350	NA**	\$38,000
<b>Received Salary Increase During Past Year</b>				
	50.8	36.0	62.5	52.9
<b>Percentage of Increase</b>				
Less than 3%	—	—	—	—
3% or 4%	9.8	4.0	25.0	5.9
5% to 9%	13.1	4.0	—	23.5
10% or more	21.3	20.0	25.0	17.6
No answer	6.6	8.0	12.5	5.9
Median =	8.9	12.0	NA**	8.5
<b>Fringe Benefits Received (Adds to more than 100% due to multiple answers)</b>				
Medical insurance (paid)	78.7	72.0	62.5	88.2
Dental insurance (paid)	41.0	32.0	25.0	52.9
Life insurance (paid)	44.3	28.0	37.5	47.1
Sick leave (paid)	63.9	64.0	62.5	52.9
Vacation (paid)	82.0	84.0	62.5	82.4
Holidays (paid)	73.8	80.0	75.0	58.8
Stock purchase plan	19.7	20.0	—	17.6
Profit sharing plan	19.7	28.0	—	23.5
Savings plan	16.4	12.0	—	23.5
Pension plan	37.7	24.0	62.5	23.5
Bonus	32.8	40.0	12.5	35.3
Trade show/convention/seminar expenses (paid)	52.5	52.0	62.5	35.3
Tuition refund plan	24.6	20.0	25.0	17.6
Automobile furnished	52.5	68.0	25.0	35.3
<b>Years in Present Job</b>				
Less than 3	11.5	8.0	—	29.4
3 or 4	14.8	4.0	37.5	29.4
5 to 9	24.6	32.0	12.5	23.5
10 to 14	16.4	24.0	25.0	—
15 or more	27.9	32.0	25.0	17.6
No answer	4.9	—	—	—
Median =	8.5	12.9	NA**	4.7
<b>Years in Mobile Radio Industry</b>				
Less than 5	6.6	4.0	12.5	11.8
5 to 9	13.1	8.0	—	35.3
10 to 14	18.0	16.0	12.5	17.6
15 to 24	31.1	32.0	50.0	23.5
25 or more	19.7	32.0	—	11.8
No answer	11.5	8.0	25.0	—
Median =	16.5	18.5	NA**	10.5
<b>Education</b>				
High school	23.0	28.0	25.0	5.9
Two years of college	27.9	32.0	25.0	23.5
Four years of college	26.2	4.0	50.0	52.9
Post-graduate school	9.8	12.0	—	17.6
Technical School	29.5	52.0	—	11.8
Military	—	—	—	—
No answer	4.9	4.0	—	—
<b>Age, Years</b>				
Under 25	—	—	—	—
25 to 34	14.8	12.0	25.0	17.6
35 to 44	36.1	36.0	37.5	47.1
45 to 54	23.0	32.0	12.5	23.5
55 to 64	16.4	12.0	12.5	11.8
65 or older	4.9	8.0	—	—
No answer	4.9	—	12.5	—
Median =	44.5	46.3	NA**	42.5

\*Due to a relatively small incidence rate for Business/Industry and Transportation Corporate Management, their responses have not been included individually, but are inclusive in the total.

\*\*NA - Not available - sample size inadequate.



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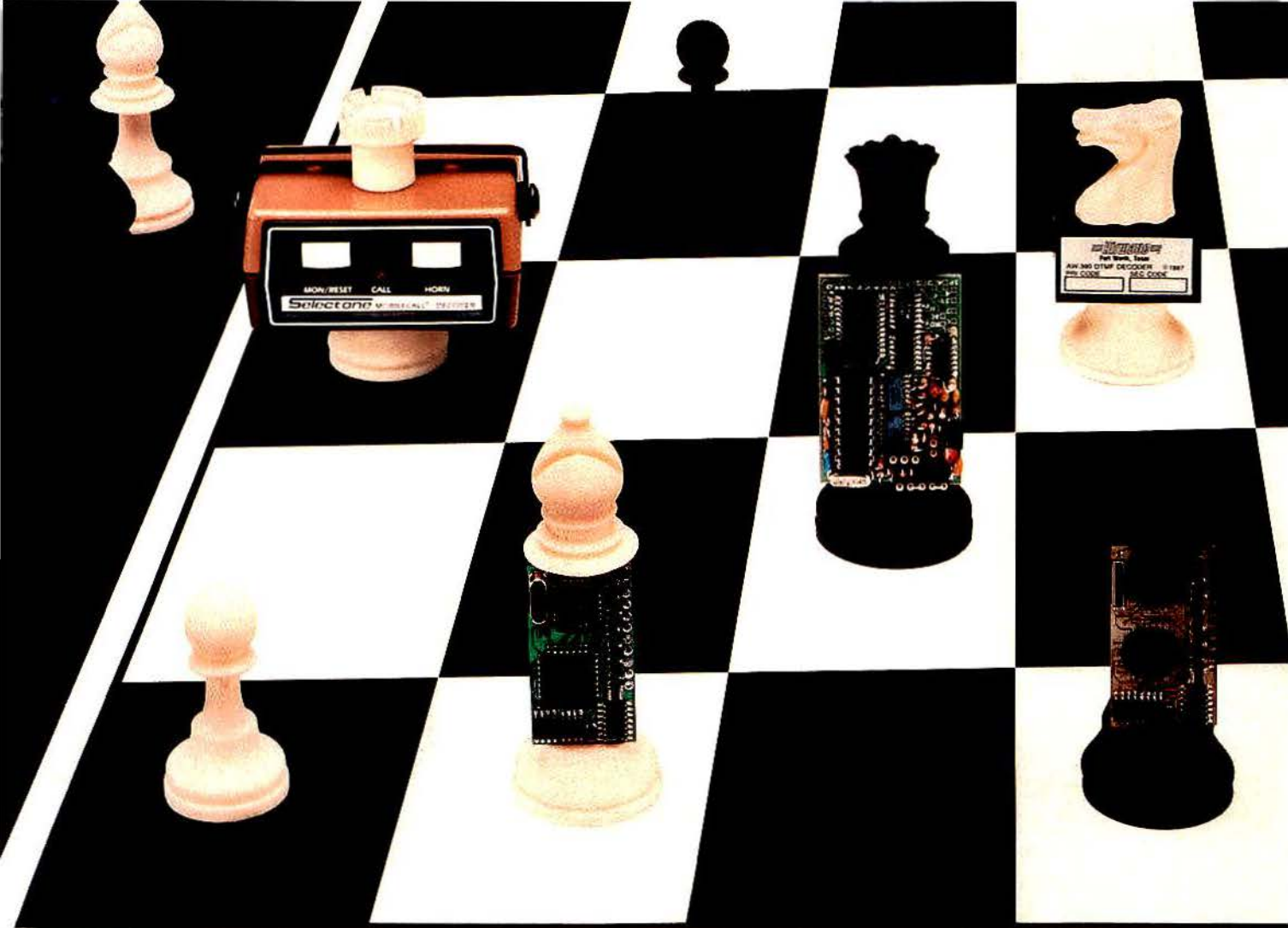




**TABLE 2 — OPERATIONS STAFF PROFILE**

	Total %	Dealers %	Public Safety %	Business/ Industry %	Transportation %	Service Providers %
<b>Salary Level</b>						
Less than \$15,000	0.7	—	—	4.0	—	—
\$15,000 to \$24,999	12.8	21.7	14.6	4.0	—	17.1
\$25,000 to \$34,999	27.0	34.8	39.6	8.0	11.8	25.7
\$35,000 to \$49,999	35.8	30.4	29.2	40.0	52.9	37.1
\$50,000 or more	23.0	13.0	16.7	44.0	29.4	20.0
No answer	0.7	—	—	—	5.9	—
Median =	\$38,950	\$33,750	\$34,200	\$48,500	\$45,850	\$38,450
<b>Received Salary Increase During Past Year</b>						
	77.0	78.3	81.3	84.0	64.7	71.4
<b>Percentage of Increase</b>						
Less than 3%	6.8	8.7	8.3	12.0	5.9	—
3% to 4%	25.0	17.4	31.3	48.0	17.6	12.0
5% to 9%	33.1	26.1	37.5	20.0	35.3	56.0
10% or more	10.8	26.1	2.1	—	5.9	32.0
No answer	1.4	—	2.1	4.0	—	—
Median =	5.4	5.9	5.1	3.5	5.7	7.7
<b>Fringe Benefits Received (Adds to more than 100% due to multiple answers)</b>						
Medical insurance (paid)	91.9	91.3	91.7	88.0	94.1	94.3
Dental insurance (paid)	71.6	87.0	54.2	68.0	82.4	82.9
Life insurance (paid)	79.1	73.9	75.0	72.0	94.1	85.7
Sick leave (paid)	89.9	78.3	97.9	88.0	82.4	91.4
Vacation (paid)	95.3	87.0	97.9	92.0	100.0	97.1
Holidays (paid)	96.6	95.7	95.8	96.0	100.0	97.1
Stock purchase plan	24.3	34.8	—	40.0	29.4	37.1
Profit sharing plan	26.4	52.2	16.7	24.0	41.2	40.0
Savings plan	33.8	39.1	64.6	40.0	47.1	42.9
Pension plan	65.5	56.5	6.3	84.0	82.4	51.4
Bonus	30.4	60.9	50.0	24.0	35.3	45.7
Trade show/convention/seminar expenses (paid)	53.4	52.2	33.3	44.0	52.9	65.7
Tuition refund plan	45.9	52.2	33.3	48.0	41.2	60.0
Automobile furnished	39.2	56.5	12.5	32.0	58.8	31.4
<b>Years In Present Job</b>						
Less than 3	23.6	30.4	12.5	12.0	5.9	51.4
3 or 4	18.4	21.7	12.5	16.0	29.4	22.9
5 to 9	22.3	30.4	18.8	28.0	29.4	14.3
10 to 14	14.9	8.7	27.1	12.0	23.5	—
15 or more	18.9	4.3	29.2	32.0	11.8	8.6
No answer	1.4	4.3	—	—	—	2.9
Median =	5.8	4.5	10.5	9.7	8.5	2.5
<b>Years In Mobile Radio Industry</b>						
Less than 5	17.6	13.0	10.4	20.0	23.5	25.7
5 to 9	16.2	17.4	14.6	8.0	5.9	28.6
10 to 14	17.6	34.8	22.9	4.0	11.8	11.4
15 to 24	23.6	17.4	20.8	24.0	41.2	22.9
25 or more	17.6	13.0	22.9	28.0	11.8	8.6
No answer	7.4	4.3	8.3	16.0	5.9	2.9
Median =	12.8	12.8	13.5	19.0	16.2	6.8
<b>Education</b>						
High school	20.3	13.0	25.0	12.0	23.5	22.9
Two years of college	29.1	52.2	35.4	16.0	17.6	20.0
Four years of college	33.1	13.0	29.2	40.0	47.1	40.0
Post-graduate school	9.5	13.0	6.3	16.0	5.9	8.6
Technical school	23.6	30.4	18.8	20.0	35.3	22.9
Military	—	—	—	—	—	—
No Answer	2.0	4.3	—	4.0	—	2.9
<b>Age, Years</b>						
Under 25	2.0	4.3	2.1	—	—	2.9
25 to 34	24.3	34.8	20.8	12.0	23.5	31.4
35 to 44	33.8	30.4	37.5	24.0	23.5	42.9
45 to 54	25.7	21.7	25.0	36.0	35.3	17.1
55 to 64	10.8	4.3	12.5	24.0	17.6	—
65 or older	—	—	—	—	—	—
No answer	3.4	4.3	2.1	4.0	—	5.7
Median =	41.6	38.6	42.2	48.9	46.7	38.3





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### TABLE 3 — TECHNICAL STAFF PROFILE

	Total %	Dealers %	Public Safety %	Business/ Industry %	Transportation %	Service Providers %
<b>Salary Level</b>						
Less than \$15,000	—	—	—	—	—	—
\$15,000 to \$24,999	12.1	28.6	14.6	8.0	10.7	6.3
\$25,000 to \$34,999	32.1	57.1	34.1	32.0	21.4	28.1
\$35,000 to \$49,999	44.3	14.3	46.3	52.0	46.4	46.9
\$50,000 or more	11.4	—	4.9	8.0	21.4	18.7
No answer	—	—	—	—	—	—
Median =	\$37,050	\$29,400	\$35,800	\$38,450	\$41,350	\$40,500
<b>Received Salary Increase During Past Year</b>						
Percentage of Increase	71.4	42.9	80.5	88.0	39.3	87.5
Less than 3%	9.3	7.1	12.2	12.0	—	12.5
3% to 4%	25.7	14.3	29.3	44.0	14.3	21.9
5% to 9%	27.9	7.1	26.8	32.0	21.4	40.6
10% or more	8.6	14.3	12.2	—	3.6	12.5
No answer	—	—	—	—	—	—
Median =	5.1	4.9	4.9	4.6	5.4	5.7
<b>Fringe Benefits Received (Adds to more than 100% due to multiple answers)</b>						
Medical insurance (paid)	87.1	92.9	73.2	96.0	85.7	96.9
Dental insurance (paid)	71.4	50.0	58.5	80.0	85.7	78.1
Life insurance (paid)	65.7	57.1	51.2	84.0	71.4	68.8
Sick leave (paid)	84.3	78.6	97.6	96.0	64.3	78.1
Vacation (paid)	97.9	92.9	100.0	100.0	96.4	96.9
Holidays (paid)	97.1	92.9	100.0	100.0	96.4	93.8
Stock purchase plan	30.0	—	4.9	64.0	32.1	46.9
Profit sharing plan	13.6	14.3	—	20.0	14.3	25.0
Savings plan	35.7	7.1	29.3	60.0	25.0	46.9
Pension plan	68.6	21.4	73.2	92.0	64.3	68.8
Bonus	15.0	7.1	—	8.0	21.4	37.5
Trade show/convention/seminar expenses (paid)	33.6	21.4	29.3	40.0	32.1	40.6
Tuition refund plan	50.7	21.4	34.1	72.0	64.3	56.3
Automobile furnished	32.9	21.4	26.8	40.0	32.1	40.6
<b>Years in Present Job</b>						
Less than 3	24.3	21.4	12.2	32.0	14.3	43.8
3 or 4	16.4	7.1	24.4	4.0	14.3	21.9
5 to 9	22.1	50.0	24.4	8.0	21.4	18.8
10 to 14	15.7	7.1	14.6	44.0	7.1	6.3
15 or more	20.0	14.3	24.4	8.0	39.3	9.4
No answer	1.4	—	—	4.0	3.6	—
Median =	6.4	6.5	7.9	10.3	9.9	3.4
<b>Years in Mobile Radio Industry</b>						
Less than 5	9.3	7.1	12.2	8.0	—	15.6
5 to 9	24.3	50.0	19.5	16.0	21.4	28.1
10 to 14	17.9	14.3	17.1	28.0	17.9	12.5
15 to 24	28.6	21.4	31.7	40.0	25.0	21.9
25 or more	15.7	7.1	12.2	4.0	28.6	21.9
No answer	4.3	—	7.3	4.0	7.1	—
Median =	12.9	9.8	14.8	12.8	18.5	12.5
<b>Education</b>						
High school	31.4	50.0	43.9	28.0	17.9	21.9
Two years of college	26.4	28.6	19.5	32.0	25.0	31.3
Four years of college	22.9	—	17.1	24.0	32.1	31.3
Post-graduate school	7.1	—	4.9	8.0	10.7	9.4
Technical school	43.6	50.0	53.7	36.0	46.4	31.3
Military	—	—	—	—	—	—
No Answer	2.1	—	2.4	4.0	3.6	—
<b>Age, Years</b>						
Under 25	0.7	—	2.4	—	—	—
25 to 34	23.6	14.3	19.5	28.0	14.3	37.5
35 to 44	32.1	78.6	19.5	28.0	39.3	25.0
45 to 54	37.1	7.1	51.2	36.0	32.1	37.5
55 to 64	2.9	—	4.9	4.0	3.6	—
65 or older	1.4	—	—	—	7.1	—
No answer	2.1	—	2.4	4.0	3.6	—
Median =	42.8	40.0	46.7	42.9	44.1	40.6



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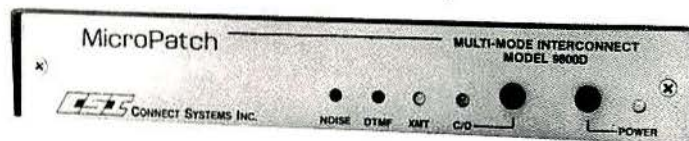
### USER SELECTABLE MODES:

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- Regular Half Duplex
- Privacy Half Duplex
- Repeater Controller
- Dial-Up Remote Base
- Dial Access Paging/Selective Calling

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- CTCSS Control Board
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### USER SELECTABLE MODES:

- VOX Control Station Patch
- Sampling Patch (VOX enhanced)
- Semi Duplex Patch
- Repeater Controller
- Dial-up Remote Base
- Dial Access Paging/Selective Calling

### OPTIONS:

- 1000 Call Two-Tone
- 1000 Call 5/6 Tone
- 38 Call CTCSS
- CTCSS Control Board
- Electronic Voice Delay
- AUX Relay

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**TABLE 4—MEDIAN TOTALS BY STAFF TYPE**

	Corporate*	Operations	Technical
Salary	\$41,000	\$38,950	\$37,050
Percent of Increase	8.9%	5.4%	5.1%
Years in Present Job	8.5	5.8	6.4
Years in Industry	16.5	12.8	12.9
Age	44.5	41.6	42.8

\*Business/Industry and Transportation segments do not involve corporate staffs.

subgroup of the operations staff. The median fell \$1,500 this year to \$34,200. The median transportation subgroup in operations also fell, but only slightly, to \$45,850, a decline of \$700 from 1988 figures.

The only other decrease in median salary falls in the technical staff business and industrial radio users subgroup. The median dropped \$300 to \$38,450.

#### % of increase

The percentage of a salary increase received should be evaluated by individuals in mobile radio when comparing income across the industry. The median percentage of increase can be significant in the growth of median salaries over the years. All three staff groups experienced an increase in the "median percentage of increase" column.

The corporate staff showed a 0.6% gain over last year in median percentage of increase received, yielding an 8.9% median increase for 1989.

Technical staff gained a mere 0.4% in the median percentage of increase received, with 5.1% as the median. For the operations staff, the increase was more substantial at 0.8%, netting a 5.4%

median increase.

Within the technical staff breakdown, dealers, service providers and business and industry segments percentage of increase plunged. Transportation and public safety sectors showed gains in percentage of increase in the technical staff.

For the operations bracket, dealers, business and industry and service providers witnessed declines in median percentage of increase, with transportation and public safety sectors median percentage of increase reported up.

In the corporate staff, dealers median percentage of increase rose, while the service providers median percentage of increase declined. The median percentage of increase for the public safety sector cannot be determined due to a low incidence rate in that category.

#### Certificate holders

Technicians in the land mobile field can be licensed or certified by various organizations, and many technicians report they are certificate holders. For those in technical positions, holding a certificate means higher wages.

In the technical staff profile, 78.6% are licensed or certified; some techni-

cians are credited by more than one group. Of the total technical staff that is certified or licensed, here are statistics on the license type or certificate:

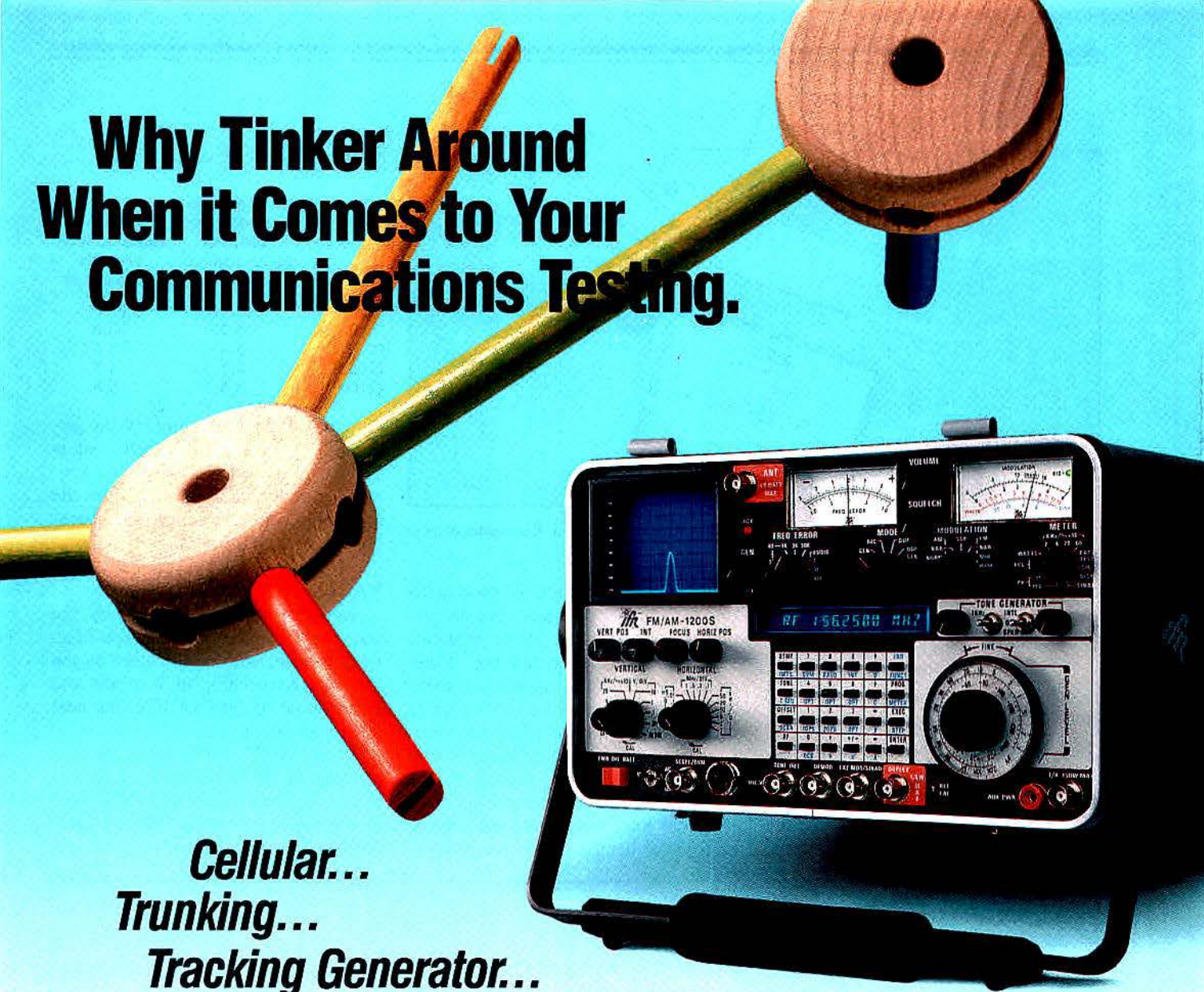
	% of total in technical staff that holds license	Of the holders, % with specific certificates
FCC	74.3	94.5
NABER	48.6	61.8
NARTE	8.6	10.9
ISCET	4.3	5.5
Other	2.9	3.6

For those falling in the technical staff profile, holding a certificate translates to a higher median salary of \$37,550. Non-certificate holders in this classification report a median salary of \$35,000, a significant difference of \$2,550.

In the corporate staff profile, 44.3% of the respondents are certified, with 92.6% of those certified holding an FCC license. Other certifications and licenses are reported in the following statistics on page 20.



# Why Tinker Around When it Comes to Your Communications Testing.



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***The FM/AM-1200S is still the most feature intensive of all communications service monitors.***

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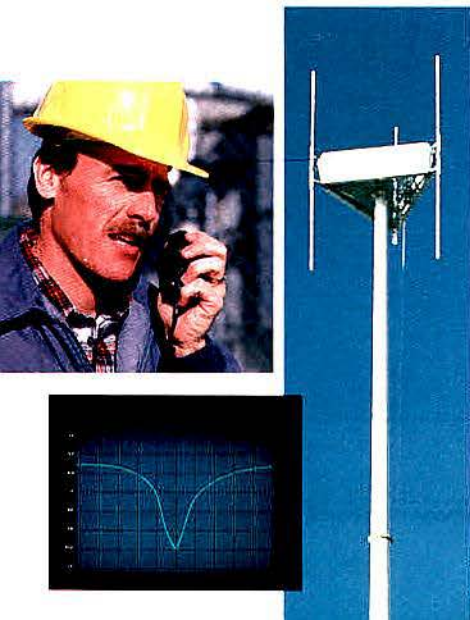
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Four groups offer certification programs for land mobile technicians. Examples of certificates from two of the organizations.

	% of total in corporate staff that holds license or certificate	Of the holders, % with specific certificates
FCC	41.0	92.6
NABER	19.7	44.4

The median salary for certificate holders in the corporate profile is \$43,350 vs. a \$38,750 median salary for non-certificate holders, a considerable difference of \$4,600.

In the operations staff, the same holds true for a higher median salary for certificate holders. In operations positions, 39.2% are certificate holders. These certificate holders earn a median salary of \$40,850, compared to a median salary of \$37,900 for non-certificate holders. Certificate holders enjoy a sizable median increase of \$2,950 over those who are not certified or licensed.

Of the total operations staff that is certified or licensed, here are statistics

on the license type or certificate:

	% of total in operations staff that holds license or certificate	Of the holders, with specific certificates
FCC	37.2	94.8
NABER	25.0	63.8
NARTE	5.4	13.8
ISCET	0.7	1.7
Other	3.4	8.6

Across all three staff profiles, the median salary for a certified technician is \$39,000 vs. a median of \$37,100 for non-certified individuals. This signifies the importance of certification and licensing in terms of salaries.

#### NABER certification

According to our Salary Survey, the majority of certified technicians hold an FCC license, with certification by the National Association of Business and Educational Radio (NABER) the next most popular choice.

When NABER started its certification program in 1984, it offered certificates to all who already held an FCC license at a grade higher than "Third Class" without requiring the applicants to pass

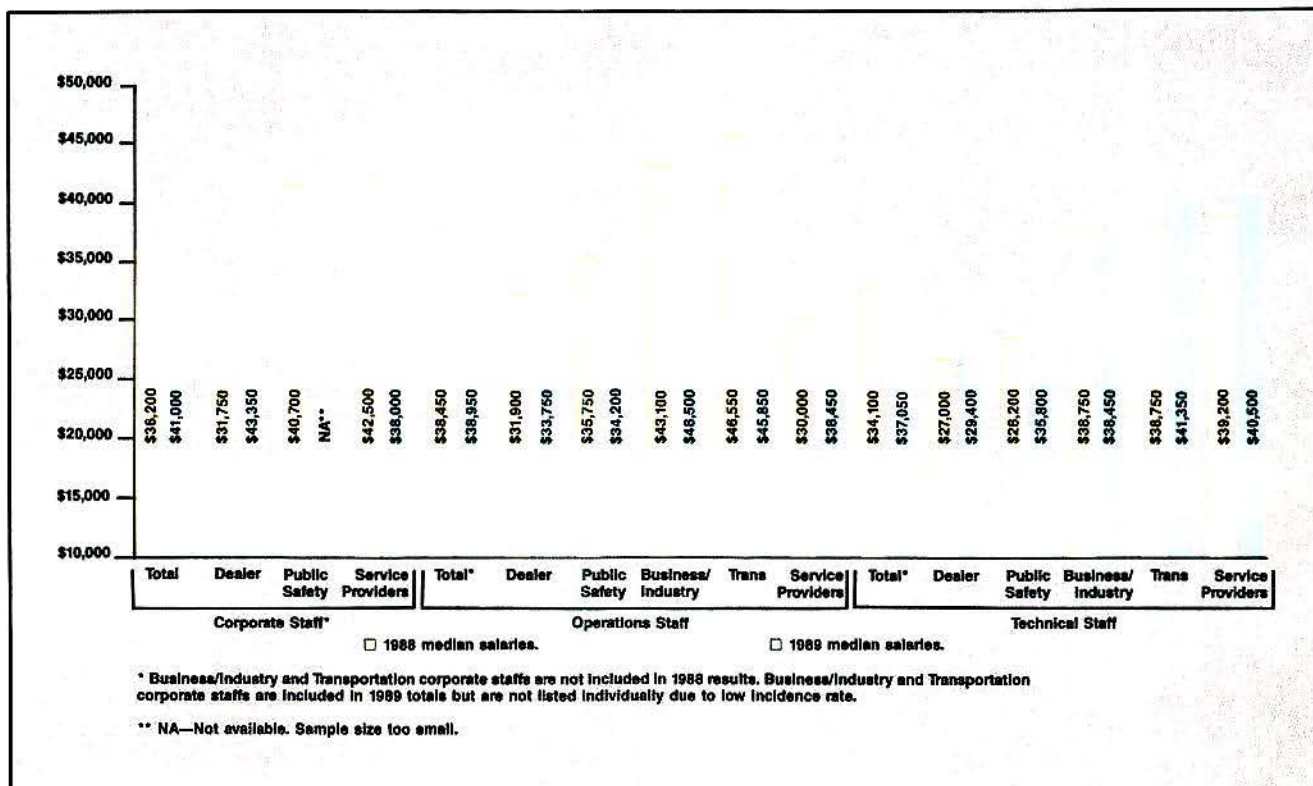
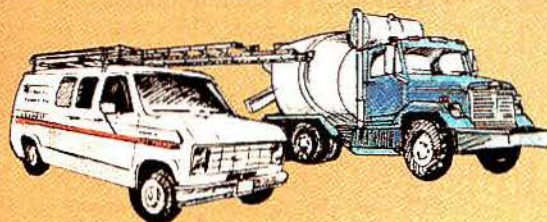
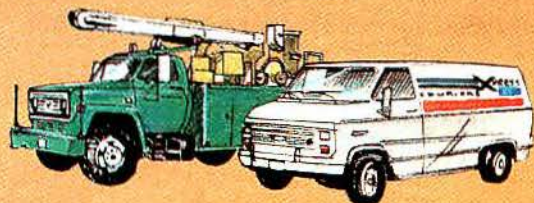
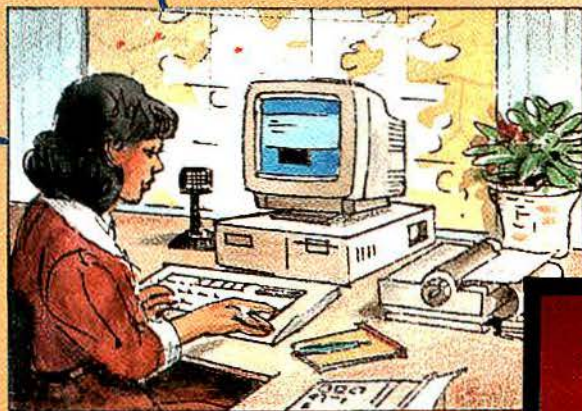


Figure 4. Comparisons of 1988 and 1989 median salaries by staff type and user type.





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an examination. By late 1984, 32,000 *grandfather* certificates were issued, after which they were unavailable.

Thus, the NABER certificate, in most cases, represents that its holder previously passed the outmoded FCC exam before 1985, instead of a current exam that measures technical competency.

The *grandfather* certificates expire after five years, but existing certificates had to be renewed by Aug. 31. Those that let their current certification expire without renewal are required to pass the NABER certification exam to requalify.

#### NARTE exam

The National Association of Radio and Television Engineers (NARTE) at press time was compiling questions for its EMC accreditation and certification examination. The exam format was expected to be completed by the end of August. The exam covers lab accreditation for technicians dealing with electromagnetic compatibility and electromagnetic interference.

The association also has grandfather candidates. An individual with nine or more years qualifies as a grandfather candidate.

Other organizations that certify land mobile technicians include the Interna-

tional Society of Certified Electronic Technicians (ISCET) and the National Institute for Certification in Engineering Technologies (NICET).

For more information on the industry certification programs, contact:

NABER, 1501 Duke St., Suite 200, Alexandria, VA 22314; 800-759-0300.

NARTE, P.O. Box 15029, Salem, OR 97309; 503-581-3336.

ISCET, 2708 W. Berry St., Fort Worth, TX 76109; 817-921-9101.

NICET, 1420 King St., Alexandria, VA 22314; 703-684-2835.

#### Geographical breakdown

For those interested in a geographical representation of respondents, Figure 5 below details the breakdown.

Many statistics besides the highlights mentioned in this text appear in the supporting tables and figures. These results perhaps will give professionals an edge when they go to negotiate salary.

Obviously it will take 12 months for these data to provide analytical trends in salary levels throughout the mobile radio industry. As the mobile radio industry and technology continue to change, these statistics will change, and *MRT* therefore will continue to conduct its annual reader Salary Survey and report the results of those surveys.

For those readers who would like to comment on salaries in the land mobile radio industry, be sure to turn to page 129 and answer this month's "What Do You Think?" questionnaire. The questionnaire addresses trends in salaries in the industry and aspects of this survey. Fill out the questionnaire and return it to us. The results of the responses will be printed in a future "Feedback" column.

#### Methodology

On June 1, 1989, the marketing research department of Intertec Publishing, under the direction of Vicki Kerns-Vaal, conducted a scientific study on salary information of professionals in the mobile radio industry.

Questionnaires were mailed to 1,554 *MRT* domestic subscribers on the *nth* name basis. On June 21, 349 usable questionnaires had been returned. This translates into a response rate of 22.5%. Data in this article are based on these responses.

The purpose of this Salary Survey is to provide mobile radio professionals with valuable information on compensation and careers that will help you better evaluate your own position and those of your colleagues.

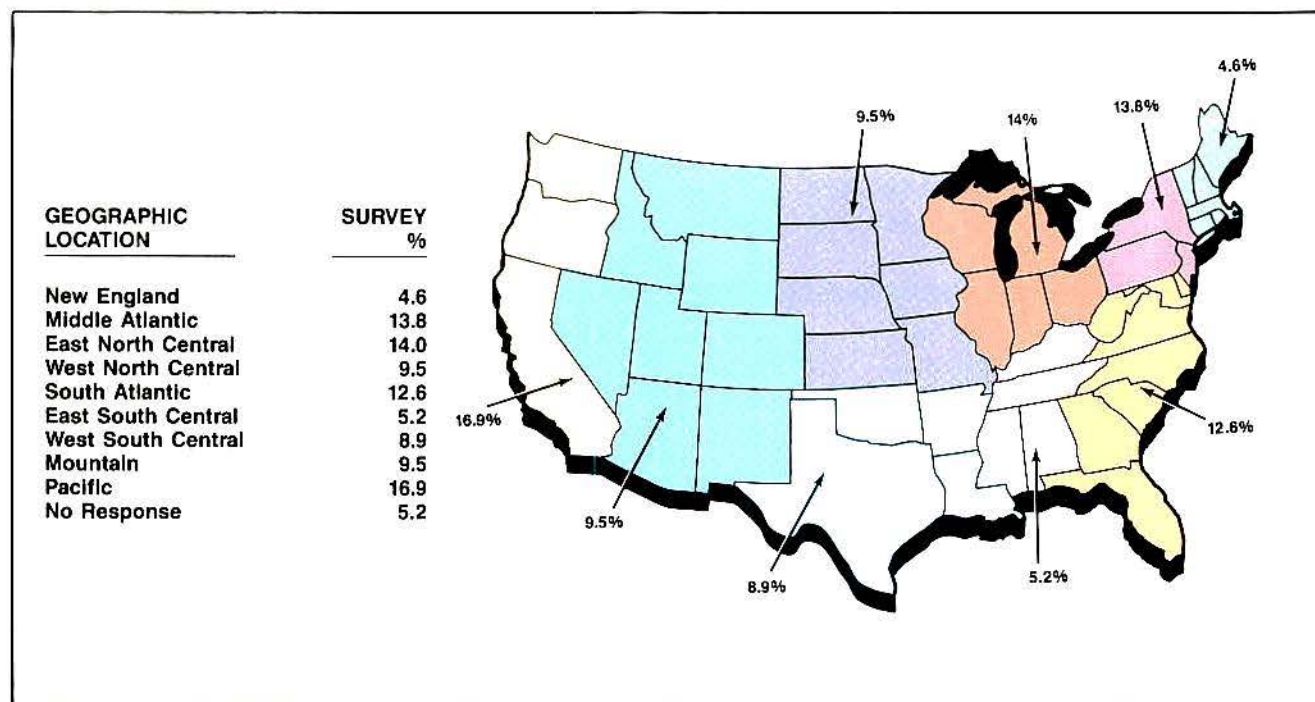


Figure 5. Breakdown of reader responses by geographic location.





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## Readers' comments

At the end of our Salary Survey, we asked readers to describe the most pressing problem facing the mobile radio industry. Comments were diverse, but many readers' comments centered on technicians' qualifications and pay, frequency congestion, frequency coordination and technological advances.

### □ **Technicians**

Readers recognize that trained and skilled technicians are a rare commodity. Low wages are partly to blame for the lack of high-quality technical personnel, readers report, but proper training and education also are responsible. From responses centering on technicians as a source of the most pressing problems, comments include:

"The most pressing problem, in my opinion, is getting qualified people to service equipment related to RF transmission."

"The lack of qualified technicians; salaries are too low."

"The lack of competent technical personnel—there are plenty of computer freaks, but fewer and fewer people who know or have any interest in radio. Radio no longer holds any interest for young people. Blame this on the FCC for the CB fiasco that gave radio communications a negative image. This also has been reflected in the declining numbers of amateur radio licensees and the decline and poor quality of the new ham licensees."

"We need a strong radio communications technical association to upgrade and standardize wages and benefits."

"Low wages. Higher pay would foster better training programs and would bring in better trained personnel. It seems that few, if any schools, currently have curricula supporting our trade."

### □ **Training**

Respondents believe training is not supported by some management and that training is deficient for most in areas of new technology. Comments pinpointing training and education as the most pressing problem include:

"Technology is advancing so fast that many technicians cannot keep up to date due to lack of funding for training. Manufacturers do not assist in teaching

technicians the 'ins and outs' of the new products. One-day seminars do not cut the mustard."

"Keeping the technical staff training up to date on emerging products."

"Maintaining proper training for technicians."

"Concise methods and knowledge to troubleshoot to component level, especially PLL circuitry."

"Technical training in surface-mount technology."

### Pressing problems

- **Finding qualified technicians.**
- **Low salaries.**
- **Frequency congestion and interference.**
- **Frequency coordination.**
- **Lack of availability of good industry knowledge and education sources.**
- **Repair difficulties posed with new products.**
- **Keeping up with new technology.**

### □ **Technology**

Technological aspects that are the subject of pressing problems include:

"It seems to me that technology is advancing so rapidly that traditional repair will be a thing of the past. Our new radios, now being installed, are impossible to work on at my shop. I will need entirely new equipment and skills to replace a defective component."

"Reluctance of manufacturers to produce a simple radio for simple needs."

"There is an increasing demand for repeaters and base stations. The industry is falling behind in development."

"The lack of field repairable radios and computer glitches in units that no one seems to have an answer to—diminishing need for repairman."

"Boards are becoming too small to repair; modular repair does not need a licensed tech."

"Board-level maintenance does not require technical people such as myself. So I need a new career."

"Complexity of equipment; adjustment to surface-mount technology."

"Moving from component-level repair to board changeout requires less skills but higher component cost. What are our next generation techs going to be like?"

### □ **Frequency availability**

Readers' comments on frequency use, availability, coordination and congestion include:

"I feel the most pressing problem is that of frequency coordination. There just never seems to be enough coverage in one's area, and applying for a new frequency is a never-ending struggle."

"Not enough research is done for frequency coordination."

"Availability of frequencies in major metro areas (land mobile RF) is far below the level needed to meet demand."

"Frequency allocation and coordination—there are too many people using frequencies that they have not been licensed for."

"Frequency spectrum—protection from broadcaster-created site management problems."

"Satisfying everybody's frequency requirements at an affordable price."

"Frequency congestion—stock piling of frequencies and SMR channels by large companies."

"Spectrum—too much valuable spectrum is tied up for frivolous purposes. Need/want ratio for radio spectrum usage is too low."

"Spectrum efficiency—need to incorporate MDT technology and trunking technology into all spectrum, not just 800MHz to 900MHz."

### □ **Miscellaneous comments**

"Interfacing of computers and computer technology in both equipment and servicing is the most pressing problem faced. How to teach all those who need to know. Specialization and depot repair? Is this what the future holds?"

"Finding 'good' technical publications to keep techs up to date on the latest technology. *MRT* is one of the best. Your articles address subjects that have been of great help to me, from a technician's point of view."





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# Repeater antenna selection and maintenance

*Practical tips help you to keep your repeater antenna in proper operating condition. Mounting, weatherproofing and troubleshooting techniques are discussed. Methods for testing the feedline are explained.*

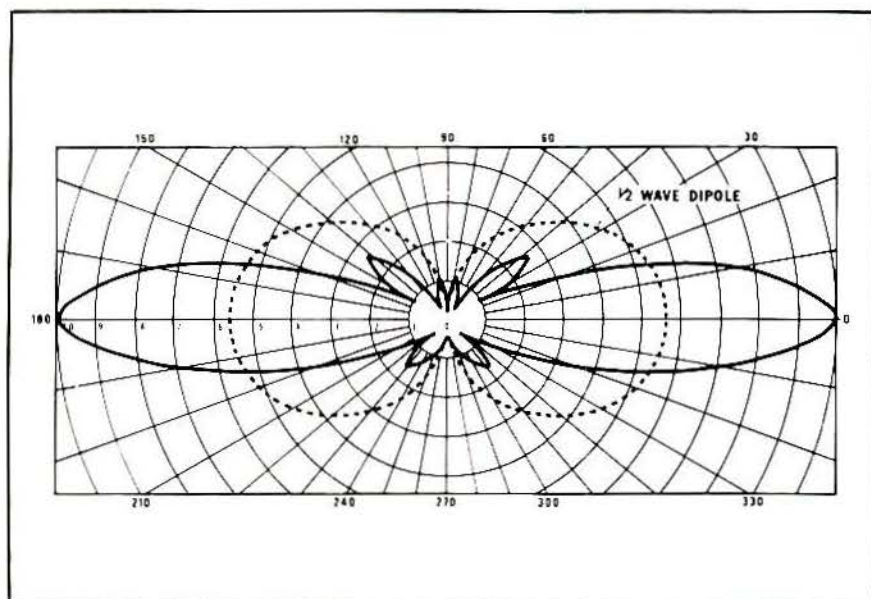


Figure 1. The vertical field pattern for the antenna shown in Photo 1 shows radio energy concentrated toward the horizon.

By Roald Steen

Important to every repeater is the antenna. The transmitter determines how much power leaves the repeater; the antenna determines how much power is emitted.

The emission pattern, how much energy is emitted in each direction along the horizon, is a primary concern in selecting an antenna for a base station or repeater. Antennas come with a variety of emission patterns. An anten-

Steen is an electronics instructor and free-lance writer. He has worked as a two-way radio technician, and he lives in Woodbury, MN.

na's emission pattern sometimes is called the antenna directivity.

If the repeater is near the center of the coverage area, an omnidirectional emission pattern is desirable. If it is near the edge of the coverage area, the emission pattern should cover only 180° or less of the horizon.

Where the geography requires unusual emission patterns, antennas usually can be found to deliver them. For example, if the area is restricted to a highway or railroad, a sharp, bidirectional pattern or tight figure eight emission pattern may do.

Some antennas offer emission patterns with downtilt to cover areas near the antenna site.

Gain, another antenna characteristic, and directivity are related: Where there is gain, there also is directivity.

With an omnidirectional antenna, gain means that the emission is concentrated toward the horizon, rather than at vertical angles. (See Figure 1 at the left and Photo 1 on page 28.) The concentration of energy near the horizon helps to cover a wide area. Most mobile units served by the repeater are likely to be only a few degrees away from the horizon, as seen from the antenna. The few mobile units that are at a greater angle from the horizon are likely to be close to the antenna. To communicate with them, less repeater power and sensitivity are needed. (See "Mobile Antenna Repair and Maintenance," November 1987).

The area to be covered establishes how much gain is desirable. For example, in covering a relatively small downtown area from a tall building antenna site, a great deal of gain may be counterproductive because with too much gain, transmitted power overshoots the area to be covered. (See Photo 2 on page 30.)

## Placement

It is common to place the antenna as high as possible, but if the area to be covered is small, it is better to choose a lower antenna location, as long as one can be found that has few obstructions to the horizon.

When the coverage area is large, such as a county, higher gain produces the best coverage. The highest possible antenna site also helps to deliver the widest coverage.



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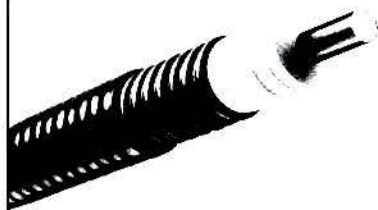
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An excellent transmitting antenna also is an excellent receiving antenna. The emission pattern and gain exhibited for transmitting also improve reception.

Some repeater antennas come with a ground plane composed of a few radial poles, and a few may require mounting on a ground plane. (See Photo 3 on page 32.) But most repeater antennas are

designed to work without a ground plane. (See Photo 4 on page 34.) Many are designed for mounting on a tower.

Some repeater antennas show dc continuity to the coaxial cable ground when they are mounted. Others show an open circuit to coaxial cable ground when measured with an ohmmeter. When you troubleshoot antenna systems, check the antenna manual to learn whether the antenna under test should show dc continuity or an open circuit to the coaxial cable ground.

A repeater antenna mounted on a tower presents a special challenge when it comes time for service. The difficult access restricts the technician's ability to make tests and repairs. Most tower-mounted antennas should be replaced or tested only by someone qualified to work on towers.

### Feedline

Coaxial cable used to feed the antenna may be of a variety of types, but the use of 50Ω cable is universal. Low-cost coaxial cable, such as RG-8, has a braided shield and losses that increase with radio frequency and cable length. Its use should be reserved for short coaxial runs and frequencies no higher than VHF.

For higher frequencies and long cable runs, low-density foam, air or pressurized nitrogen dielectric coaxial cables with solid shields are preferred. These cables are more difficult to install and replace than cables with braided shields, but they are extremely durable.

Coaxial cable performance degrades with time when moisture seeps into the cable. Braided cables are especially susceptible to moisture, which usually enters at connections.

The high-density foam dielectric used in braided cable has more loss than low-density foam, air or nitrogen dielectric used in cables with solid shields. For the higher frequencies and longer cable runs, solid-shield coaxial cable may be pressurized with nitrogen to keep moisture out.

Check the pressure in nitrogen-filled cable regularly. If your service shop maintains sites that use pressurized cable, check and record the nitrogen pressure whenever you visit those sites. Some sites with pressurized cable are equipped with telemetry signaling to

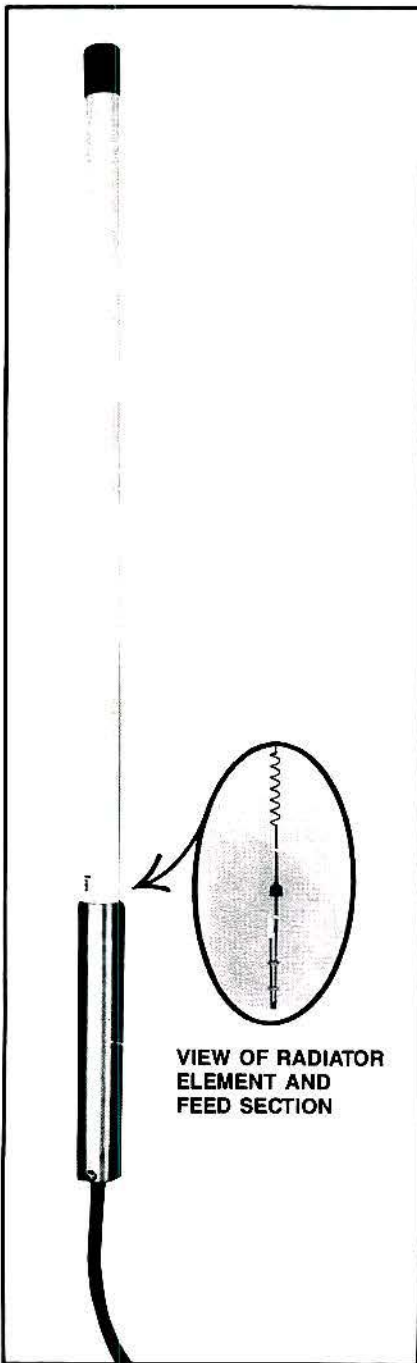


Photo 1. A collinear, radome-enclosed omnidirectional antenna. (Photo courtesy of Antenna Specialists. Also see Figure 1.)



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emit an alarm whenever the nitrogen pressure drops too low. It is a good idea to keep a spare nitrogen bottle at sites where coaxial cables are pressurized.

Degradation due to moisture usually is not severe in a properly installed coaxial cable, so it usually is not necessary to replace a cable for this reason alone.

The first step in troubleshooting a

possible antenna problem is a visual inspection. Check to see whether it is in place and intact. For antennas mounted on a tower or on top of tall buildings, bring binoculars to help with the inspection.

Weather may cause antenna problems. In some areas during winter, ice may cover an antenna.

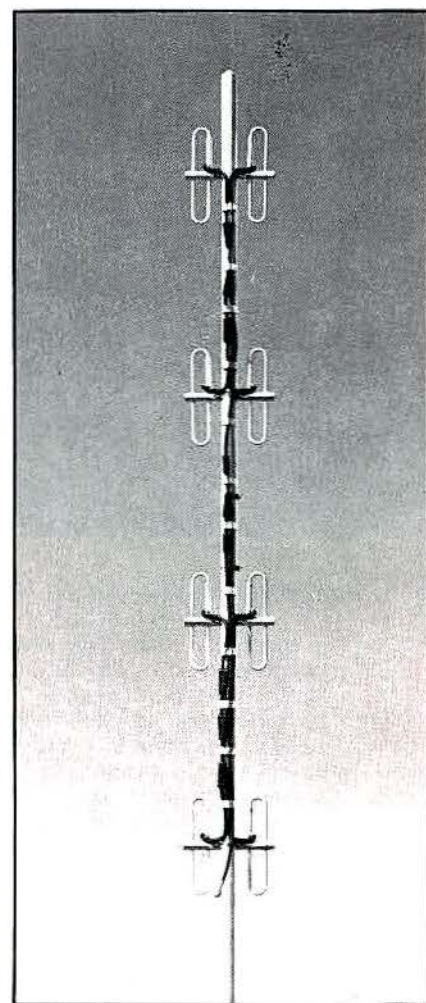
The primary instrument for antenna

service is a wattmeter. Measure forward and reflected power at the transmitter end of the coaxial cable. Much more than 2% to 5% reflected power indicates a problem that requires attention.

### Troubleshooting

For easily accessible antennas, simple tests may be used to isolate a system problem.

Two technicians working together can more easily make the required measurements. One places the wattmeter in line



**Photo 2.** An eight-pole, exposed folded-dipole antenna offers high gain that may be suitable for extended range but not close-in coverage, depending on mounting height and terrain. (Photo courtesy of Cushcraft.)

with the coaxial cable at the antenna while the other controls the transmitter while ensuring that no power is applied when the antenna is detached or while the other technician has contact with the

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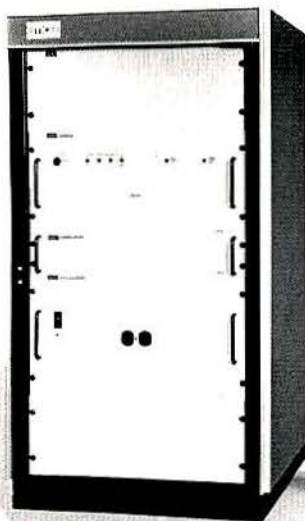


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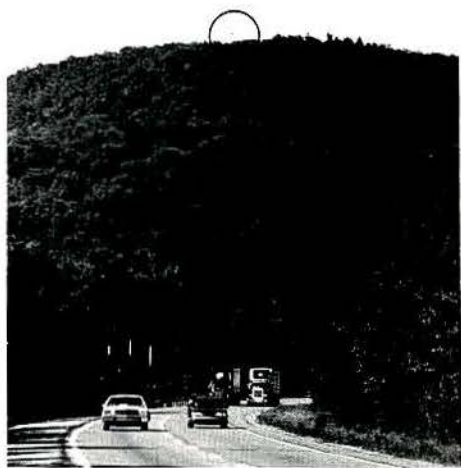


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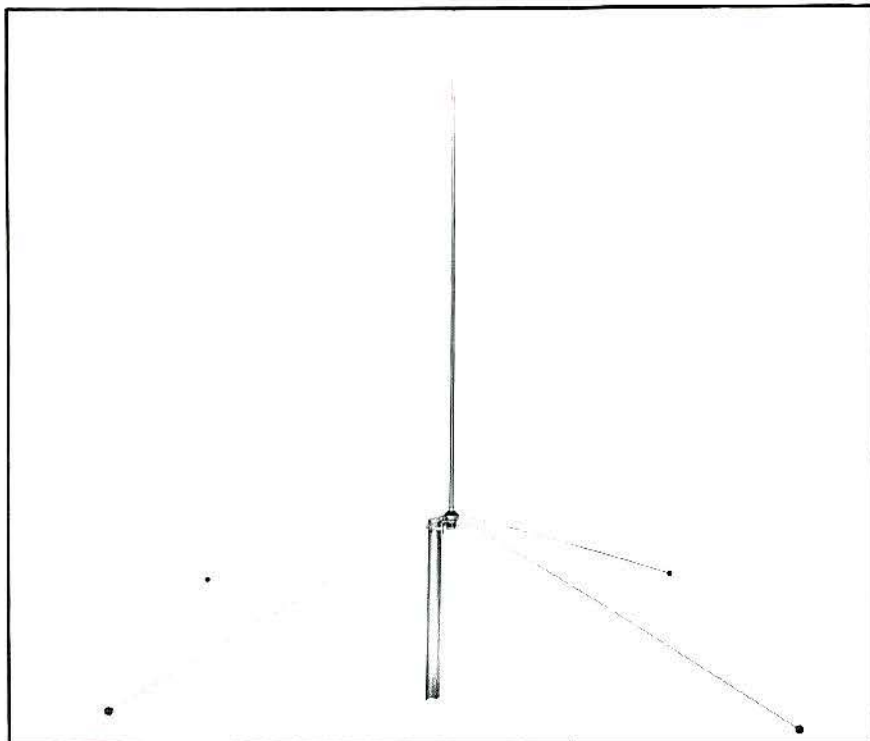


Photo 3. A light-duty quarterwave ground plane antenna that uses radials. (Photo courtesy of Antenna Specialists.)

antenna system. Their efforts can be coordinated via hand-held two-way radios.

Compare power measurements made at the antenna with measurements made at the transmitter. The comparison reveals how much power is lost in the coaxial cable and may indicate whether there is a problem in the antenna.

Forward power always is somewhat less at the antenna than at the repeater output because of coaxial cable losses. For the same reason, reflected power normally is somewhat higher at the antenna.

As another test, apply transmitter power through the wattmeter into a dummy load instead of into the antenna. This test may provide information about the quality of the coaxial cable and the antenna, as the dummy load presents a nearly perfect match to the coaxial line and to the repeater.

#### Continuity

A simple continuity test of a coaxial cable can be useful. If the antenna is the

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type that normally shows a dc continuity to the coaxial cable shield, it must be disconnected from the cable for this test. If the antenna normally shows an open circuit to the coaxial cable shield, it does not need to be disconnected.

Connect an ohmmeter to the shield and the center conductor of the cable at the repeater end. If the cable has no short circuit between the center conductor and its shield, the ohmmeter will show an open circuit.

Place a clip lead at the antenna end between the shield and center conductor or between the shield and the antenna (depending on the type of antenna and whether you disconnected it). The ohmmeter should show a short circuit.

This simple test reveals many serious coaxial cable faults. An exception is loss caused by moisture.

#### Reflectometer

A time domain reflectometer (TDR) can provide a great deal of information about the state of the coaxial cable through measurements made at the

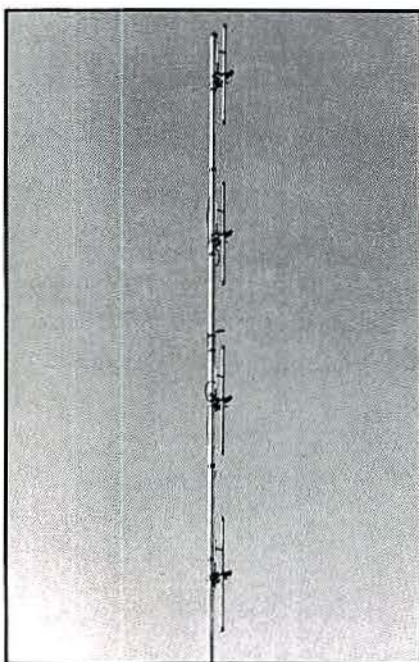


Photo 4. A four-pole, exposed-dipole antenna designed to work without a ground plane, as are most base station and repeater antennas. (Photo courtesy of Cushcraft.)

repeater end. (See Photos 5 and 6 on page 36.) Valid indications of the cable's condition from TDR testing are best obtained by comparing present results with previous TDR readings made when the antenna system was known to be in good working order.

A TDR shows the location of mismatches throughout the cable. There always are small mismatches at connectors. Other mismatches may occur where the cable has been bent, twisted or compressed. TDR readings can be used to pinpoint cable damage that may not be revealed by visual inspection.

The cable's velocity factor must be known to accurately determine the location of a fault revealed by the TDR. The velocity factor is listed in the information sheet from the coaxial cable manufacturer. It usually is around 0.80 to 0.95. Look in the TDR operator's manual for information on how to locate a problem using the velocity factor.

#### Safety first

Always be careful to disable the

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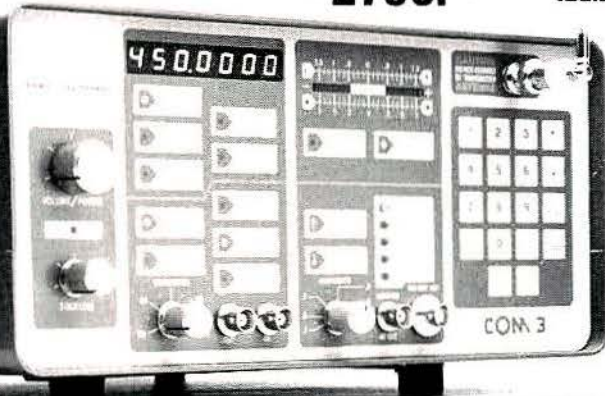
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Photos 5 and 6. Time domain reflectometers (TDRs) help determine impedance mismatches caused by cable damage or loose connections. The simple



model at the left has a digital display; the model at the right includes a waveform display and printer. (Photos courtesy of Riser-Bond Instruments.)

transmitter before touching the antenna or opening a connector at the coaxial cable. Before the transmitter is re-activated, the technician at the repeater end should use the portable radio to verify that the technician by the wattmeter is ready and is not touching any part of the antenna. Respect the amount of power that a repeater can transmit. Do not stay too close to the antenna when the transmitter is on.

Repeater antennas normally are quite durable. But they are exposed to all kinds of weather. During winter in some areas, snow and ice may cause temporary problems. Lightning may hit exposed antennas or nearby objects, causing damage to the antenna or coaxial cable. But a properly installed repeater antenna should be well protected against damage from most lightning strikes.

Special problems may be encountered when the antenna is placed in a corrosive environment. For example, antennas near the ocean are subject to salt deposits. Clean the salt deposits from antennas with a brush and fresh water.

Repeater antennas should not, as a rule, be repaired. If the antenna is found to be defective, it is wise to replace it with a new one.

The connector between the antenna

and coaxial cable is a weak point in many installations. Make sure the connector is sealed well against moisture during installation.

#### Tower climbing

Climbing towers is a task that should be performed by commercial tower crews. It takes a good deal of experience and training, together with the right tools, to perform maintenance work on towers.

Some special problems are encountered in older antenna support structures, such as smokestacks and older buildings. Steps and other supports intended as climbing aids may be rusty, corroded and unsafe. Seek qualified advice as to whether these structures may be climbed safely.

The climbing belt is an important tool for tower climbing. Use a modern belt made from nylon or polyester.

Servicing repeater antennas often requires a coordinated effort with tower climbers. Some tests may be made from the ground. The results may isolate the problem elsewhere from the antenna, avoiding the need for a tower crew.

With the more accessible rooftop antennas, you may be able to perform complete service on the antenna system.

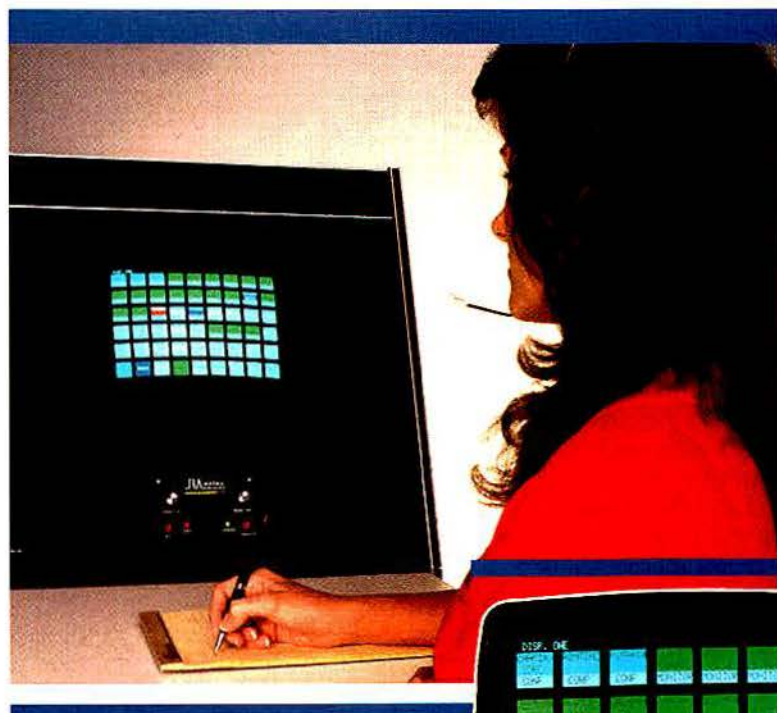




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# Helical antennas replace lowband quarterwave whips

*Omnidirectional, vertically polarized radio waves emanate from an innovative helical antenna. Its low profile has advantages in VHF lowband applications. Controlled design characteristics make it work.*

By Don Bishop  
Editorial Director

Tall whip antennas mounted on vehicles have a greater exposure to damage than short antennas. The use of lower frequencies makes the problem worse because, generally, the lower the frequency, the taller the antenna. A quarterwave whip at 50MHz, the highest lowband VHF frequency, might be as tall as 50 inches. Thus, lowband VHF whip antennas may suffer more damage than other antennas because of their height.

Antennas may be damaged by mechanical booms, ladders or other equipment used as part of the vehicle. They may be damaged when the vehicle passes beneath trees or structures such as building overhangs, doors and parking garage ceilings.

An alternative lowband antenna design—*helical*, for short—reduces the vertical dimension to 5.75 inches to keep the antenna out of harm's way. The antenna's full technical name is a tongue twister: a resonant, monofilar, normal-mode helical antenna. It looks like a squat version of an automobile suspen-

sion spring. (See Photo 1 at the left.)

To explain the name:

"Resonant" means the antenna's electrical length is a quarter-wavelength.

"Monofilar" means the antenna has a single coil or "helix." "Multifilar" helical antennas use two or more interleaved coils. They are used more commonly to fit circular polarization requirements.

"Normal-mode" means the antenna sends and receives radio signals perpendicular to its sides, instead of the top or bottom.

"Helical" refers to the shape, which resembles a helix.

## Polarization

The helical antenna shown in the photo has vertical polarization to make it compatible with vertically polarized base station and mobile antennas normally used for two-way radio communication.

Radio waves may be made to "line up" along an axis, vertically, horizontally or at any angle in between, and to change their polarization in some applications. For the strongest signal, all the units in a given system should use the same polarization.

Depending upon the helical antenna's shape, and how and where the feedline is connected:

- ☐ Its polarization may be horizontal, vertical or circular.
- ☐ Its maximum emission may be from the top or from the sides.
- ☐ Its antenna pattern may be omnidirectional or directional.

Moreover, performance depends in part on the coil material's diameter, which affects radiation resistance and

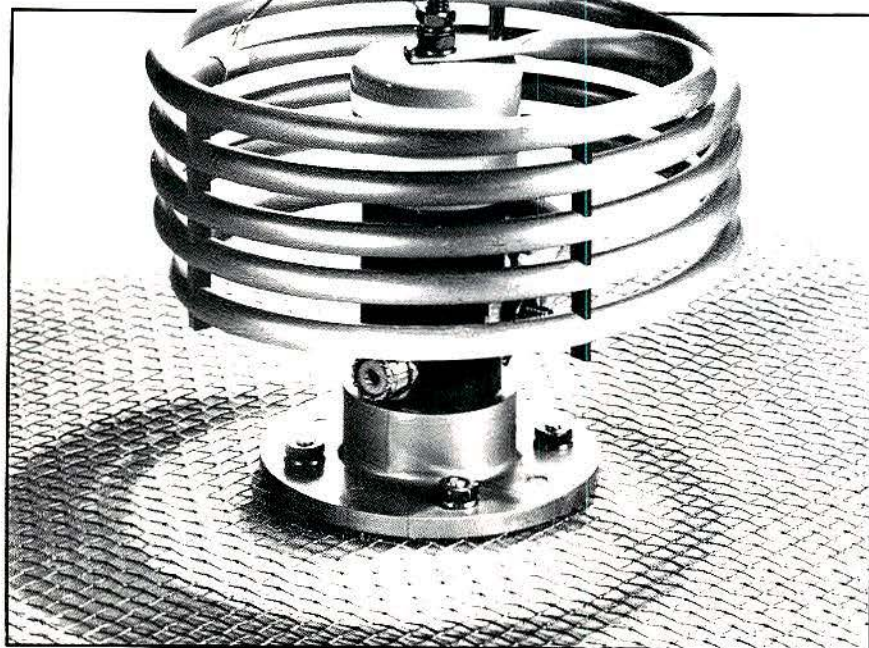


Photo 1. A resonant, monofilar, normal-mode helical antenna made by Com-Rad Industries, Grand Island, NY, looks like a squat version of an automobile suspension spring. Taps adjust the resonant frequen-

cy and feedpoint impedance. The antenna, shown mounted on a wire-screen groundplane, normally is mounted on a metal surface and is encased in a radome.



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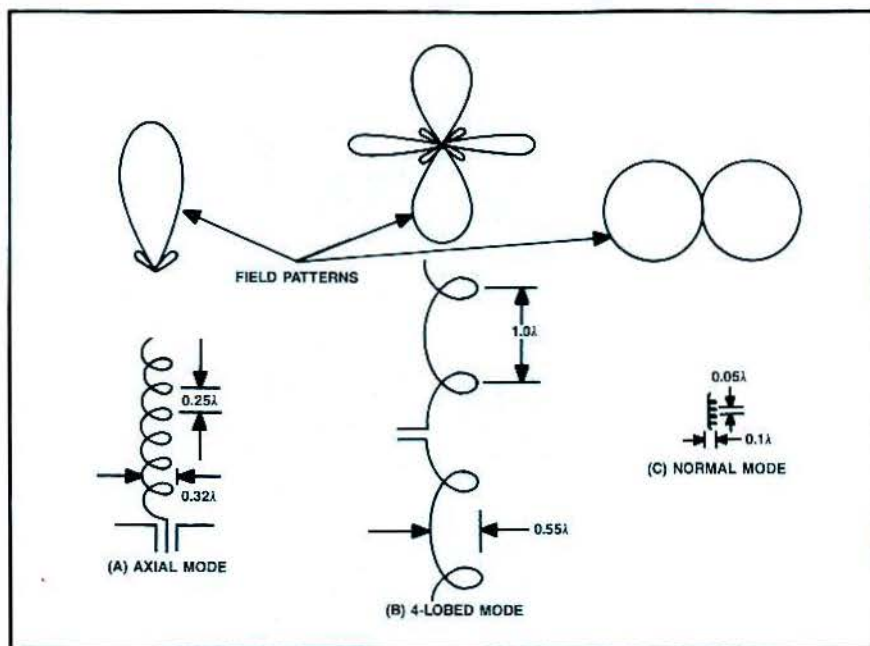


Figure 1. A coaxial-fed axial-mode helical antenna (A) mounted on a ground plane emits maximum energy from the top of the helix. A more elongated, center-fed helix (B) emits energy in four lobes, top and bottom and side-to-side, encompassing both

the axial and normal modes. The normal-mode helical antenna (C) mounted on a ground plane emits a vertically polarized, omnidirectional signal. The drawing sizes indicate relative sizes of the helices.

thus conductor losses and bandwidth.

• **Polarization**—Squat (as opposed to elongated) coil shapes essentially have vertical polarization. A helical antenna mounted on a ground plane with its axis vertical to the ground plane works as a resonant, narrowband replacement for a quarterwave whip above a ground plane.

A metal surface, such as a vehicle rooftop, serves as a ground plane. When a metal surface is unavailable, a ground plane made of wire screen can be used as a substitute. A screen approximately 24" × 30" works well for a lowband VHF helical antenna.

• **Maximum emission**—When the helical antenna's circumference approximates a wavelength, maximum signal emits along the axis, that is, from the top or bottom, or both. This type of helical antenna is called an "axial-mode" antenna.

When the helical antenna's circumference is much shorter than a wavelength, a maximum signal emits perpendicular to the axis, that is, from

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Photo 2. Garage doors pose no problem for a helical antenna in a radome atop a Libertylines Express bus.

the sides. This type of helical antenna is called a "normal-mode" antenna.

• *Antenna pattern*—When the helical antenna's coil shape is elongated with as

much as one wavelength between coils and when the coil circumference is increased beyond a wavelength ( $\lambda$ ), the antenna pattern has multiple lobes of maximum signal and nulls of minimum signal. It is not omnidirectional.

When the coil shape is squat, with less than  $0.05\lambda$  between coils; and when the circumference is much less than a wavelength (for example,  $0.1\lambda$ ), the antenna pattern is omnidirectional.

At 50MHz, the uppermost lowband VHF frequency,  $\lambda = 234$  inches;  $0.05\lambda = 11.7$  inches;  $0.1\lambda = 23$  inches. The helical antenna shown in Photo 1 has less than 1 inch between coils, and its circumference is 20.4 inches. Thus, it can be expected to have a vertically polarized, omnidirectional pattern.

The radiation resistance between the base of a short helical antenna and ground can be expected to be as little as  $0.6\Omega$ , which is extremely low. Using a 3/8-inch diameter tubing and increasing the diameter of the helical antenna, as was done with the version shown in Figure 1 on page 40, raises the radia-

tion resistance. The higher radiation resistance reduces conductor losses and increases the bandwidth.

To connect a coaxial feedline at the

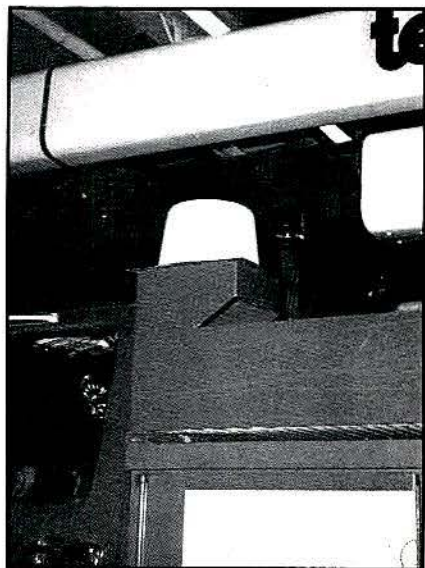


Photo 3. The mechanical boom on a West Penn Power utility truck clears a radome-encased helical antenna.

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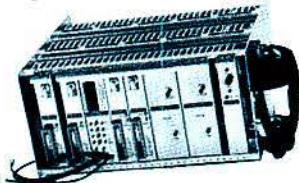
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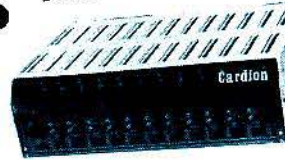
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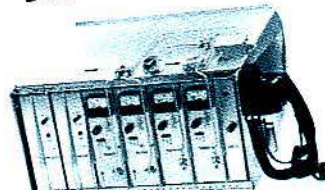
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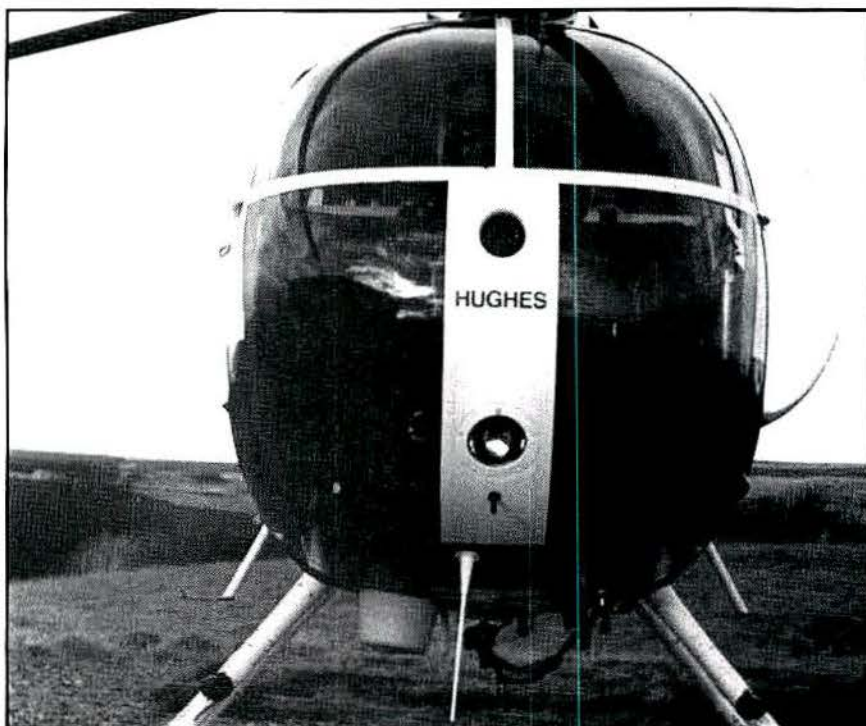


Photo 4. A helical antenna is encased in a radome underneath a helicopter belonging to Dan Gliko Helicopters, Belt, MT.

base point requires an impedance transformer. Instead, the helical antenna shown in the example uses a shunt feed. The adjustable feed taps the coil at a point with 50Ω impedance to match the common coaxial cable impedance of 50Ω.

Another tap near the top of the coil adjusts the antenna's resonance to the frequency chosen by the user.

#### Applications

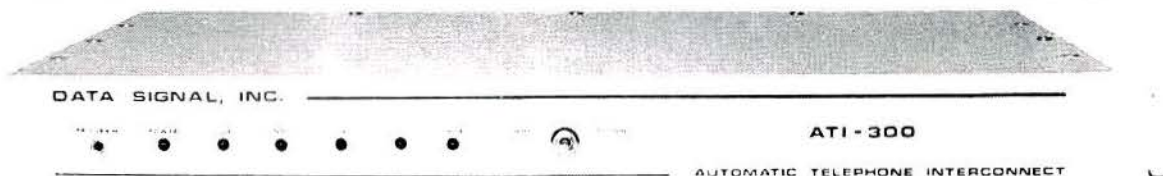
The helical antenna eliminates garage-door clearance problems for bus line (Photo 2 on page 42); mechanical-boom clearance problems for a utility company (Photo 3 on page 42); and in something of the reverse of an overhead-clearance problem, fits underneath a helicopter to clear the ground when the helicopter is earthbound (Photo 4 at the left).

#### Reference

Kraus, John Daniel, *Antennas*, second edition, McGraw-Hill, New York, 1988.



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- Direct Voice Dispatching
- Selective Calling (DTMF-DTMF)
- Mobile Activity and Timeout Timer
- Ringout or Auto Answer on 1-4 rings
- Busy Channel Ringout Inhibit
- Transorb Lightning Protection
- Front Panel station LED's
- COS polarity reversal
- 12 VDC powered

#### ATI-300 \$495-\$595

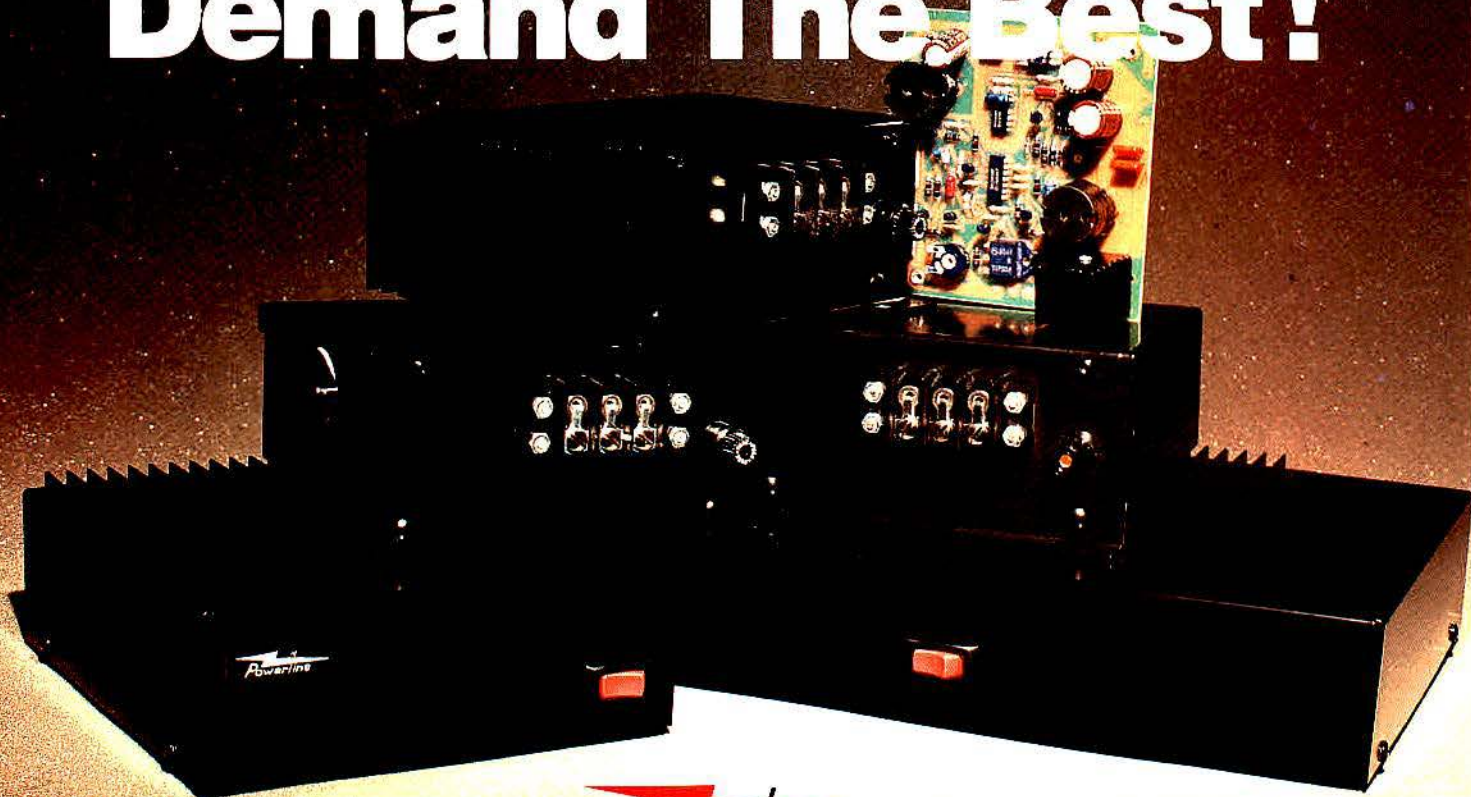
- All of the Features of the ATI-100, plus:
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- Verified Positive Disconnect
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- Control Station capabilities
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- Mobile-to-mobile Selective Call
- Verified Repeater Access
- CWID-Local or Remote Programmable
- Channel Monitor Capabilities
- DTMF or Rotary Overdialing
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- Dial Tone Disconnect
- Telco Go-ahead Tone (Programmable)
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- Dip Switch Selectable Features
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- Half-Duplex Privacy Modes
- Busy Lockout
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The R12L is a new slimline power supply measuring only 2 1/2" high! That means you can put a mobile radio on it without building a mountain of hardware. It is CSA rated at 11amps (12amps surge) and utilizes dual output devices and 105°C capacitors for improved reliability. Over-voltage crowbar circuits and true foldback current limiting are features of the R12L that combine to provide years of trouble-free operation.

The R12L is also available in the same slimline size with an internal speaker (R12L/SP).



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RCS 15 - a superb battery back-up supervisory system.

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24/12HD - the 24v. to 12v. power converter that everyone is talking about.

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# Modular design delivers 'flexible' paging terminals

*Bus structure allows you to plug almost any circuit board card into any slot. Microprocessors increase expansion and option flexibility. Today's paging terminal design keeps pace with rapid industry growth.*

By Timothy D. Minter

*Flexibility* describes the most important aspect of today's paging equipment. Without flexibility, equipment becomes obsolete when paging technology improves.

Fast advancing obsolescence has plagued the paging industry since it began. Many factors drive obsolescence, including customer demands and improvements in pager technology.

Paging system operators survive and grow in the rapidly evolving industry by responding to technical and marketplace changes without having to replace fixed equipment, such as the paging terminal that processes telephone calls.

In fact, to understand a "flexible"

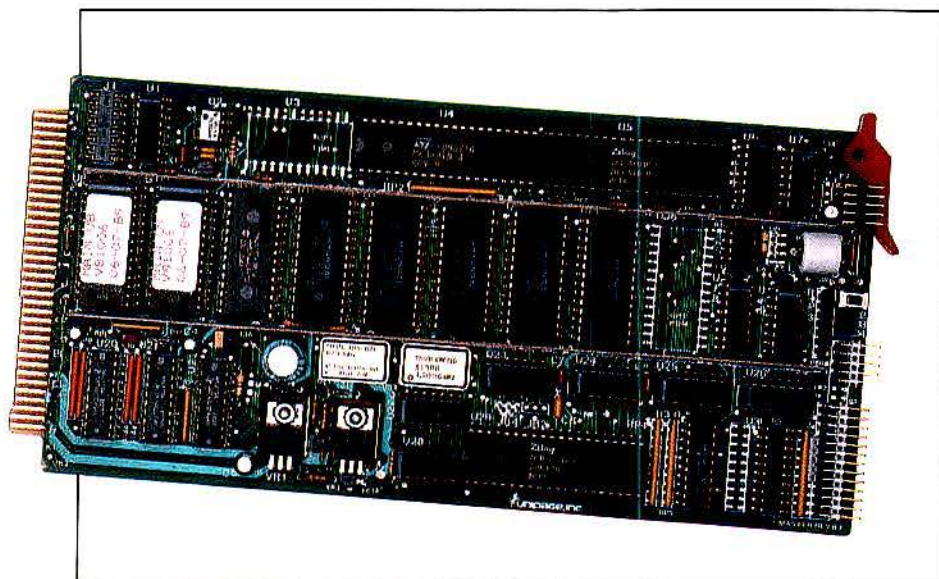


Photo 1. Flexible processor design allows one paging terminal card to be programmed as a paging encoder, an electronic memory, a network interface, a redundant system link, an alphanumeric input port or a mainframe computer interface.

Minter is president of Unipage, DeSoto, TX.

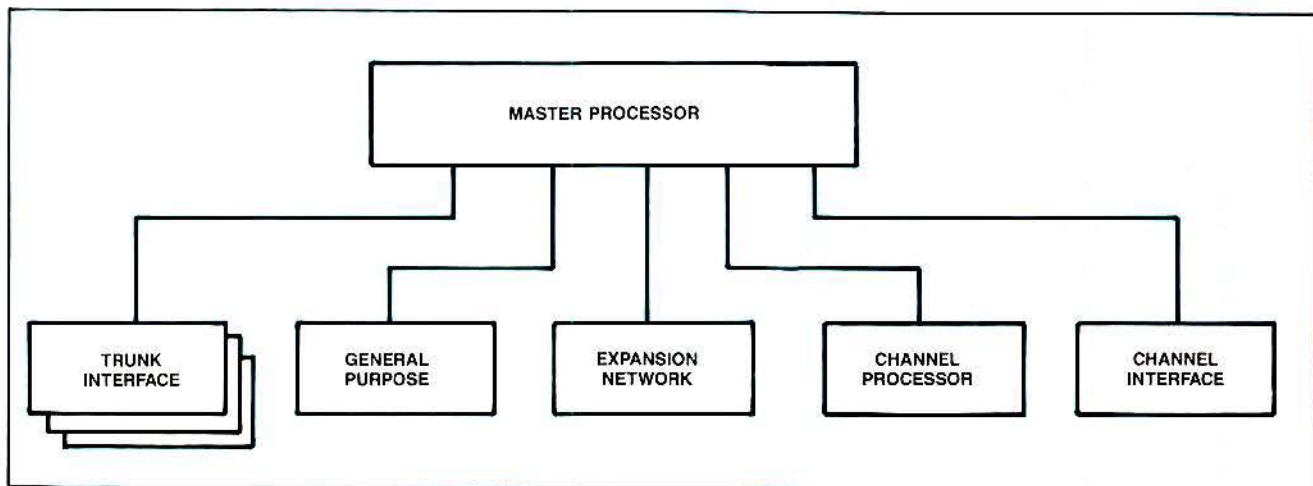
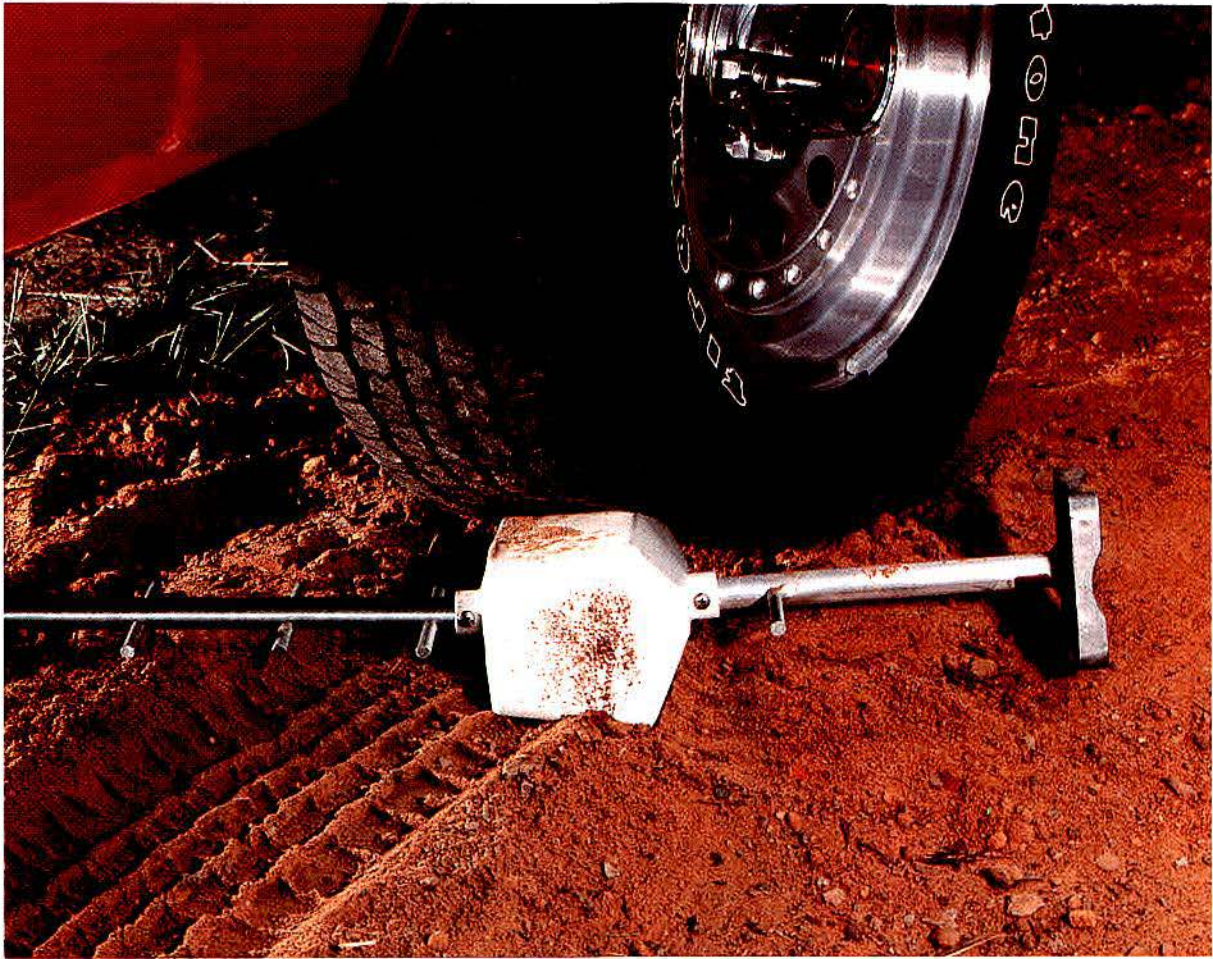


Figure 1. The key to the paging terminal's flexibility is its use of common hardware in the form of processor boards. Software programming distinguishes one board's function from another.



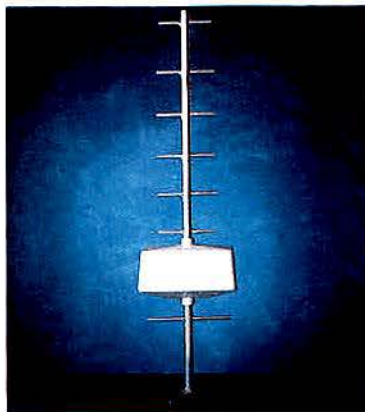
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How rugged is it? Rugged enough to get run over and come out undamaged. Rugged enough to be part of an 806-960 MHz antenna specifically designed for control station operation with director and reflector elements of solid 6061-T6 aluminum rod precision welded to eliminate misalignment problems during shipping, installation and service. You can't get more rugged than that.



The radome completely encloses the active element eliminating pattern distortions caused by

icing or heavy rain. This true 10 dB Yagi (E.I.A. Standard 329) has a VSWR under 1.5:1 for a bandwidth exceeding 80 MHz. The small surface area of the PD10108 antenna minimizes wind resistance and conserves tower loading capacity while providing heavy duty coverage.

Altogether, the PD10108 Yagi gives Celwave a very tough to overcome advantage in customizing solutions to your antenna site problems. At the very top, the very bottom and everywhere in between.

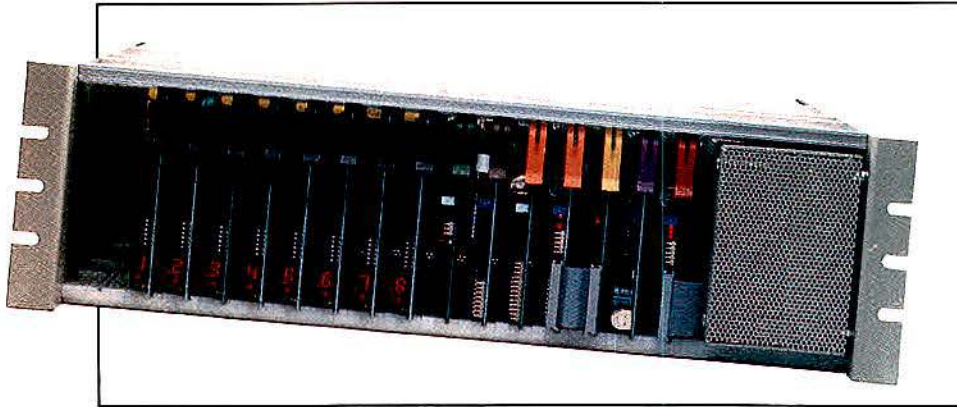
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# CELWAVE

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**Photo 2.** With a modular design, a complete paging terminal can be configured using a few cards.

paging terminal's construction, it helps to think of it as more than a "machine that processes the calls."

For example, an architect uses walls to define a building's limits, contents and structure to define a building's uses, and doors and windows to connect the building with the world outside. A building sized and conformed to a particular occupant's requirement may suit

that occupant, but the same design may not serve well for others. With each new set of requirements, the architect must start from scratch with a new design.

On the other hand, *modular* construction would use flexible combinations of similar modules to produce buildings suitable for occupants with diverse needs. Specialized modules would be selected for specific functions, such as

loading docks and restrooms. Each module would be inexpensive, and its function would depend upon its internal fittings.

Similarly, today's paging terminal engineer configures a modular terminal to fit a specific customer's current requirements. The terminal may be reconfigured to meet future requirements. The modules are *hardware*, and the "internal fittings" are *software*. A paging terminal's flexibility lies in the flexibility of its modules.

### Microprocessor

True modularity results from microprocessor control. (See Figure 1 on page 46.) Processor cards fitted with the inexpensive, proven Z-80 microprocessor chip have the flexibility to be configured as a paging encoder, a memory card, a network interface, a redundant system link, an alphanumeric input port and an interface to a mainframe computer, among other functions. (See Photo 1 on page 46.) All that is required is the appropriate software (and



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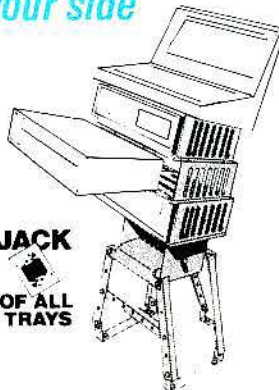
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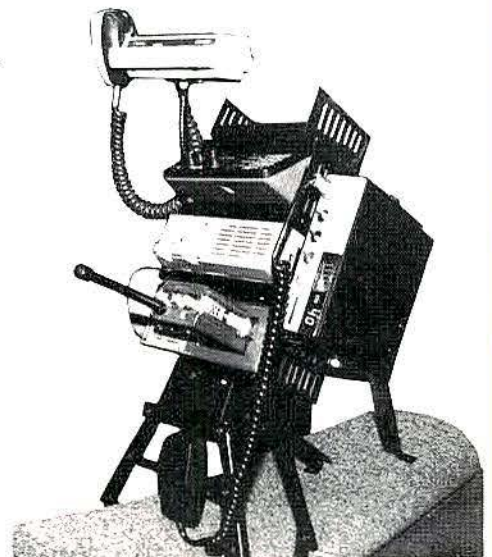
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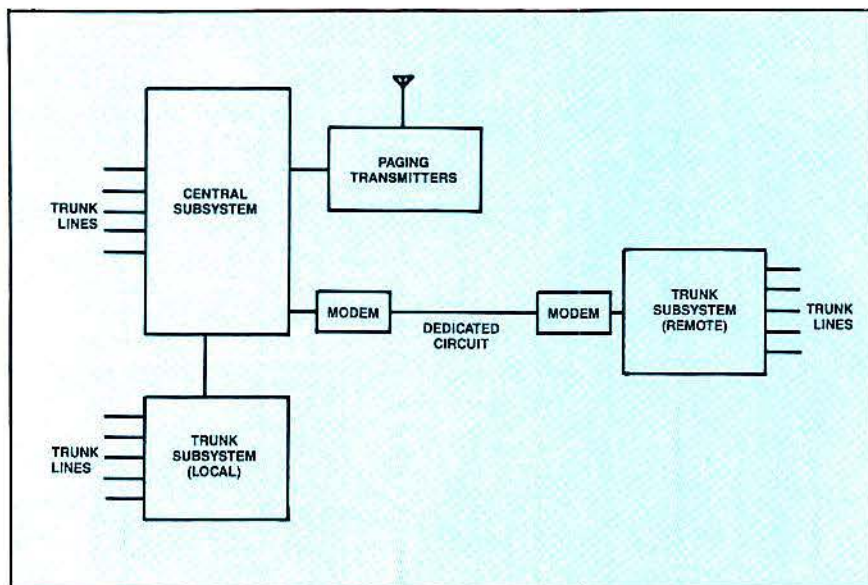


Figure 2. One configuration of a paging system uses a centralized subsystem fed by trunk lines of its own, by a hardwired local expansion subsystem and by a remote subsystem connected via a dedicated telephone circuit.

sometimes one other card) to configure the processor card as special hardware for a particular application.

Here are some examples:

- *Trunk interface card*—A single card processes incoming and outgoing calls.

and voice links between independent operating sections of the paging system. It connects with any level of service, including ringup, selector level and Type II interconnect.

- *Digital recorder card*—The voice storage processor converts a caller's voice to digital data that are held until an output channel becomes available. The card's microprocessor constantly monitors the voice to compress silent intervals, saving airtime. As many as four 30-second messages may be stored on each card. As many as eight digital voice prompts, in multiple languages, may be used as an alternative to "beep" prompts.

- *Voice processing module*—Numeric and voice message storage and retrieval, and custom greetings for each subscriber come from a voice processing module.

#### Bus design

Bus structure, borrowed from computer design, allows a terminal to be built with a series of general purpose

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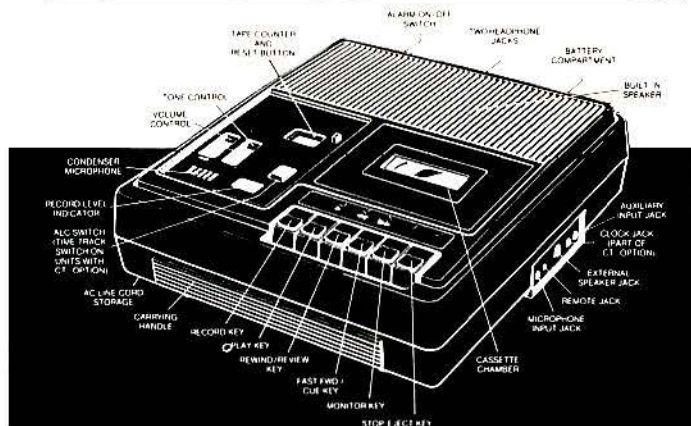
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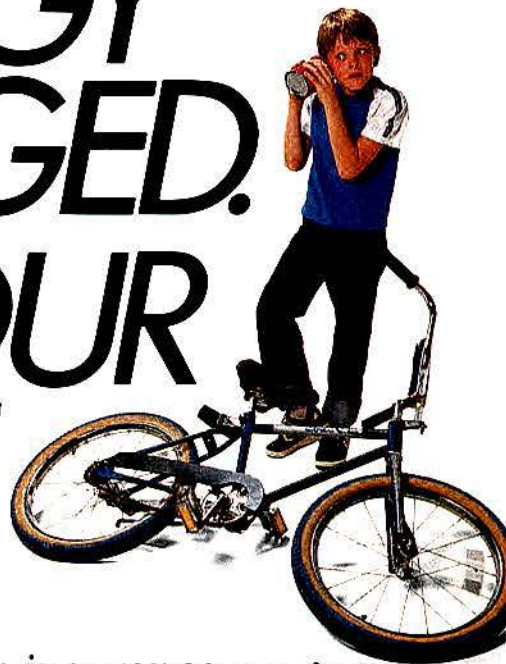
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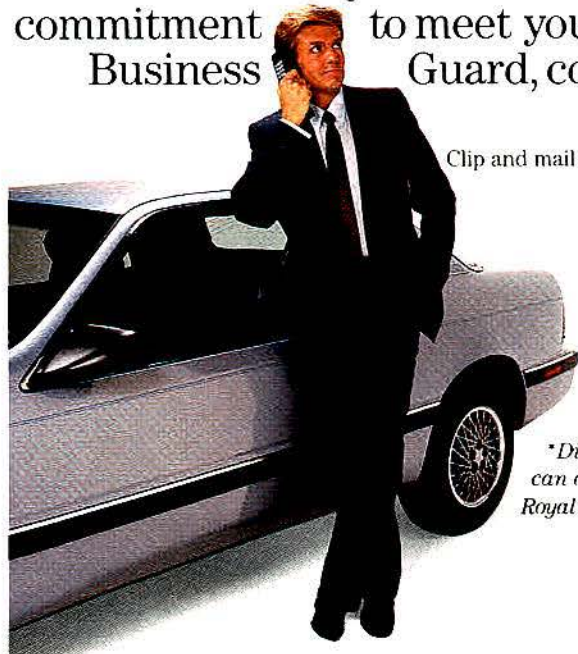
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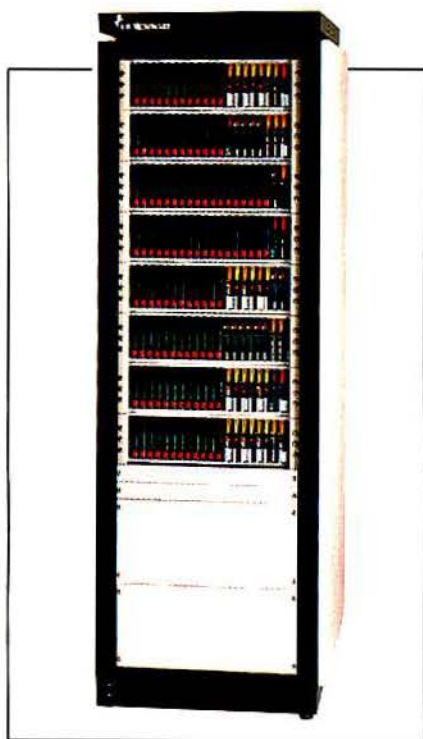
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**Photo 3.** A modular system allows virtually unlimited growth. This system uses the same modules as the small system shown in Photo 2.

slots. These slots accept circuit boards that add any combination of features. Almost any module may be plugged into any slot.

Beyond card-level modularity is another, higher level of modularity. A paging system can be configured as a cluster of subsystems operating independently or together. The terminals share resources via high-speed digital datalinks. As the system grows, the processing load is distributed over many subsystems to provide for almost unlimited growth. The terminals share memory, paging outputs and voice processing. (See Figure 2 on page 50.)

Sections of the system can be located together or separated to provide security and diverse redundancy. They can be placed across the nation as elements of a national network. Any crucial element of the system can be made redundant without duplicating the entire system.

Modular design makes it possible to configure a small paging system using a set of modules to serve a few trunks, a single channel and a few hundred

paggers; as a system with thousands of trunks serving millions of subscribers; or any system requirement in between. (See Photo 2 on page 48 and Photo 3 at the left.)

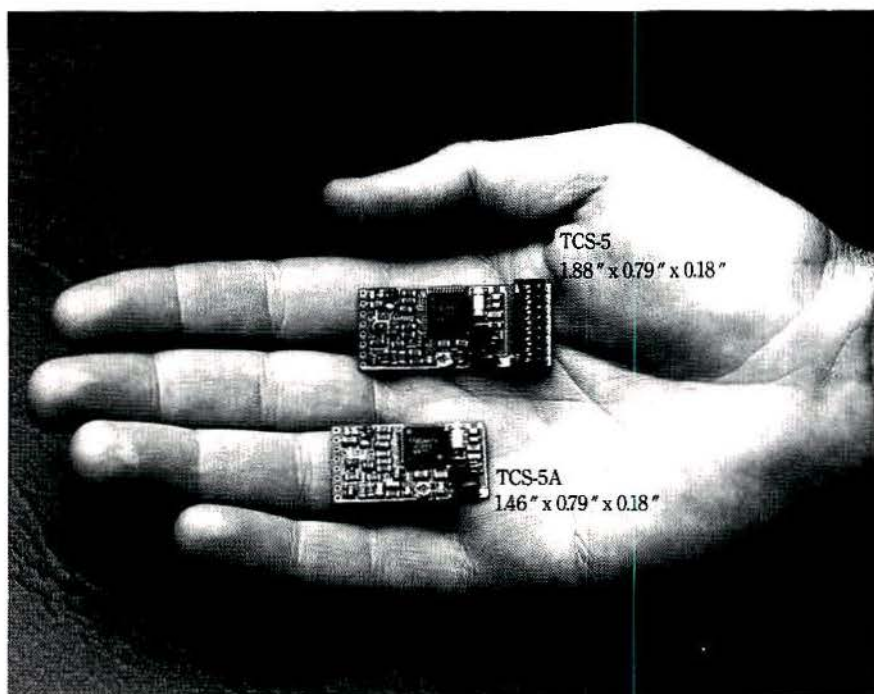
Flexible hardware modules combine with flexible software modules to allow quick development of system improvements.

Hidden advantages include easier factory testing, fewer on-site spare cards and lower costs.

Using a limited number of modules allows each card to be more thoroughly tested at each manufacturing stage. The fewer the modules, the more economical the manufacturing process.

The system operator usually needs only three to seven spare cards for critical system functions.

Paging terminal design advances to keep pace with industry growth, a growth that demands flexibility and expansion capability. Modular design delivers paging terminals that meet the needs of paging system operators.



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# QUINTRON



# Telocator 41st Annual Convention & Exposition

Telocator's 41st Annual Convention & Exposition kicks off Thursday, Oct. 5, in Washington, DC, and runs through Saturday, Oct. 7. As many as 150 exhibitors are expected to congregate at the Washington Convention Center to show the latest technological developments. Some manufacturers will have new products on display; others will showcase prototype units.

Fresh techniques in evolving systems are scheduled in the show's sessions programming. Topics include a look ahead at the 21st century; technical aspects of voice messaging, paging and cellular mobile telephony; and financial and marketing concepts.

The sessions incorporate "track programs" and early bird sessions. Five tracks are scheduled: marketing, technical, enhanced information, regulatory/legislative and consolidations. On Oct.

**Event:** Telocator 41st Annual Convention & Exposition

**Dates:** Oct. 4-7

**Location:** Washington Convention Center

**City:** Washington, DC

**Number of Exhibitors:** 150

**Projected Attendance:** 3,500

**Exhibit Hours:** Thursday, Oct. 5, noon to 5 p.m.

Friday, Oct. 6, noon to 6 p.m.

Saturday, Oct. 7, 9 a.m. to noon

**Seminar Schedule:** Thursday, Oct. 5, 9 a.m. to noon

Friday, Oct. 6, 8 a.m. to noon

Saturday, Oct. 7, 8 a.m. to noon

**Registration/Hotel Information:** 202-467-4781

5 and 6, sessions do not conflict with exhibit floor hours.

For a complete rundown on session titles, dates and times, refer to the "Ses-

sions" guide below and on page 56.

Current copies of *MRT* may be found on exhibit in booth 424.

## Sessions

DAY	TIME	TOPIC
Thursday, Oct. 5	9-9:30 a.m.	Telocator Business: State of the Association
	9:30-10 a.m.	Featured Speaker
	10-10:45 a.m.	The Spirit of Service
	11 a.m.-noon	Building, Buying and Selling RSAs
		Paging Challenges of the Future
Friday, Oct. 6	8 to 9 a.m.	Early Bird I—Technical/Financial Analysis for Capital Equipment Purchases
		Early Bird II—Alphanumeric Touch-Tone Paging
		Early Bird III—Financial Case Study
	9-10:30 a.m.	Marketing—Major Corporate Accounts



# BUILT TO GO THE DISTANCE

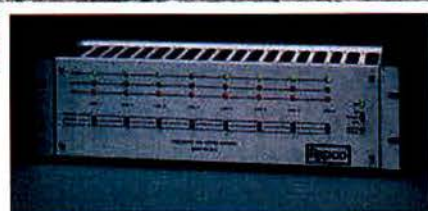


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## CREATING PRODUCTS THAT COMMUNICATE...QUALITY



## Sessions

DAY	TIME	TOPIC
Friday, Oct. 6 continued	9-10:30 a.m.	Technical—System Engineering Considerations
		Enhanced Information—Voice Messaging Link Between Paging and Cellular
		Regulatory/Legislative—Pending Mobilecom Issues in Congress
		Consolidations—Valuation and Investment Issues
	10:45 a.m.-noon	Marketing—Marketing Awards Winners—The Reasons Why
		Technical—Satellite Technology Advances
		Enhanced Information—Applications with Alphanumeric Paging
		Regulatory/Legislative—How the FCC Can Be More Helpful to the Public
		Consolidations—Merging Operations
Saturday, Oct. 7	8-9 a.m.	Early Bird I—Systems Management for Optimizing Airtime
		Early Bird II—Valuation Case Study
		Early Bird III—CT2—North American Prospects
	9-10:30 a.m.	Marketing—Niche Marketing
		Technical—Implementing Expanded Spectrum 832 and Digital into the Network
		Enhanced Information—Toward the Year 2001
		Consolidations—Financial Reporting and Tax Issues
	10:45 a.m.-noon	Marketing—Alternative Cellular Marketing Channels
		Enhanced Information—Data Applications
		Consolidations—Legal Issues
		Regulatory/Legislative—ONA and Mobilecom
	12:15-2 p.m.	Farewell Luncheon







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## Sikes nominated FCC chairman; two named to fill commission slots

Alfred Sikes, former assistant secretary of commerce and head of the National Telecommunications and Information Administration, has received the White House nomination for FCC chairman. If the Senate confirms the nomination, Sikes will replace Dennis Patrick, who tendered his resignation in April, effective upon confirmation of a new chairman.

Sikes has been nominated for the seat vacated by Mimi Weyforth Dawson and

the remainder of a five-year term that expires June 30, 1993.

In other appointments, Sherrie Marshall and Andrew Barrett are administration preferences to fill two commission vacancies. Marshall is an attorney with Wiley, Rein and Fielding, Washington, DC, and has been an aide to Patrick. Marshall would serve the remainder of the term of departing FCC chairman Dennis Patrick, which ends June 30, 1992.

Barrett is with the Illinois Commerce Commission and is a former Missouri radio station owner. His term would extend to June 30, 1990, completing former FCC chairman Mark Fowler's term.

The nominations have been submitted to the Senate for confirmation. No date has been announced for confirmation hearings. Two previous Reagan administration nominees, Bradley Holmes and Susan Wing, never were confirmed.

## Racom, Fisher Controls sign pact for automation systems

Racom, Marshalltown, IA, and Fisher Controls, New Orleans, will jointly develop automation systems for the oil and gas industry. The first application is the installation of automatic systems on gas wells in the San Juan Basin area of northwestern New Mexico.

Racom's data and voice two-way radio communications equipment is used to

transmit information from the wells back to a Fisher master operations computer. Fisher supplies the system's remote operations controllers, measurement and control elements, and system integration to automate the well sites.

Racom is a franchised GE manufacturer's representative and the largest GE distributor in the United States.

## Glenayre names agency for public relations, advertising

Glenayre Electronics, Vancouver, British Columbia, has appointed Chicago-based Stevens Kirkland Kreer as its advertising and public relations agency. The agency covers Glenayre subsidiaries as well, including Kustom Electronics, Lenexa, KS; Multitone Electronics; RMS Industrial Controls; 10 radio common carriers in Canada; and other holdings.

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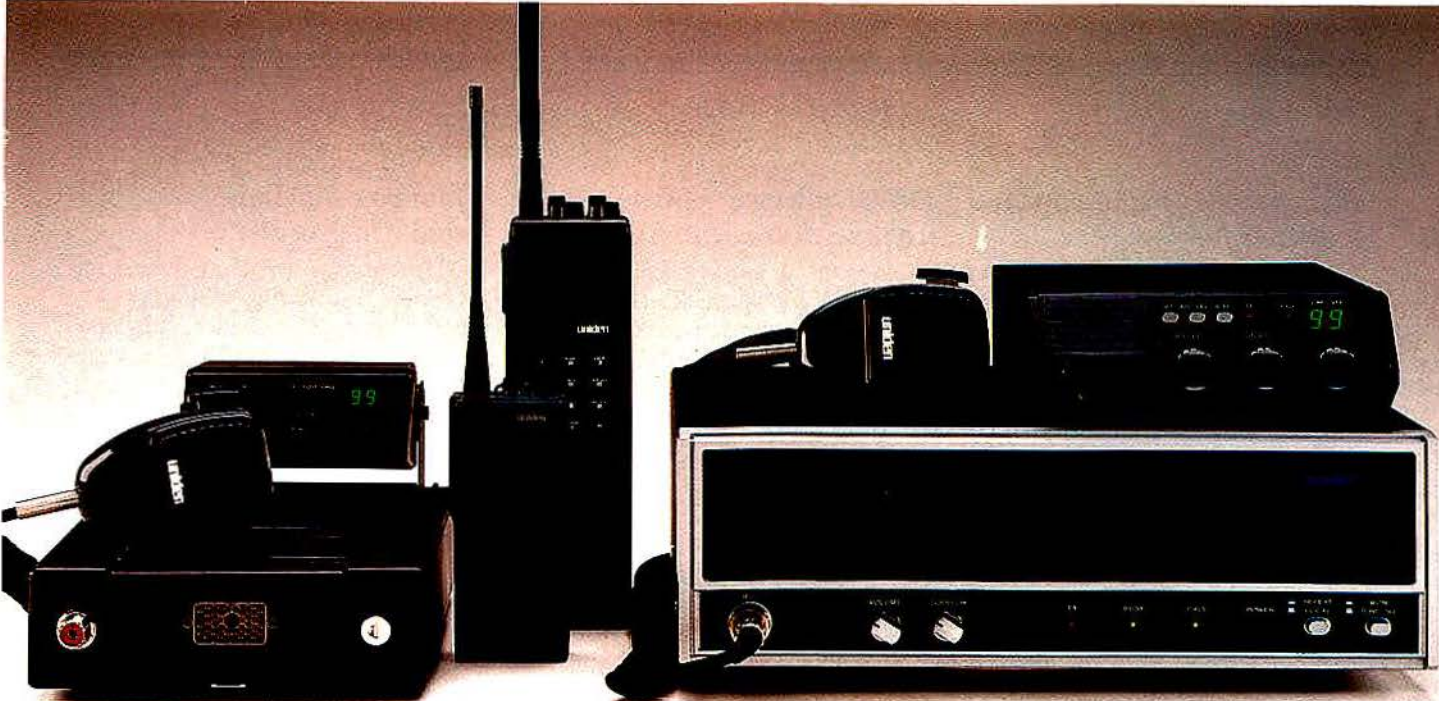
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The Choice of Professional  
Golfer Jack Nicklaus.

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A New Generation of Communications

Circle (47) on Fast Fact Card





## Glenayre sells paging system to Boeing Aerospace

Glenayre Electronics, Vancouver, British Columbia, has sold six GL3000s radiopaging terminals, spares and associated transmitter equipment to Seattle-based Boeing Aerospace. The equipment is part of ground-based command, control and communications systems in the Middle East.

## NEC America moves mobile division to Texas

As part of a reorganization, NEC America's Mobile Radio Division will be moving its headquarters from Hawthorne, CA, to Richardson, TX, this spring. The move will involve administration, marketing, sales, customer service, product engineering and billing/collections.

## Quintron develops monitoring center

Quintron, Quincy, IL, is developing a central monitoring and diagnostic center that is scheduled for completion this year. The system will monitor paging and two-way systems around the clock.

The center will be capable of receiving system alarms and polling sites regularly and diagnosing abnormal conditions. Upon alarm notification, center personnel will dispatch subcontracted local service for necessary repairs.

The system is being developed in response to requests by regional Bell operating companies and large radio common carriers, according to Quintron.

When the center is completed, Quintron will provide site monitoring and maintenance of Telecom USA paging systems.

## Glenayre, Trans Canada plan to merge communications

Glenayre, Toronto, and Trans Canada's (TCG) communications division, a national cellular communications sales, service and distribution network, intend to merge their communications businesses, pending proper approvals.

Under the proposal, TCG will hold a majority interest in Glenayre, and Glenayre shareholders will have a strong minority interest in both companies.

In another move, Glenayre has sold two GL 3000 integrated paging and voice retrieval systems to Hutchinson Telecommunications of Australia.

The company has sold an IMTS radiotelephone terminal to CIDCOM, Santiago, Chile.

## Sony plunges into mobile communications market

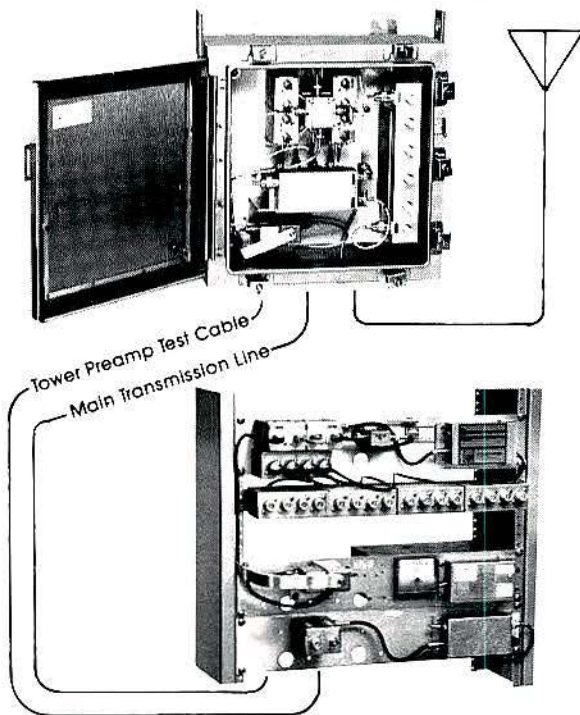
Sony, New York, is entering the two-way satellite mobile market this fall with its 2-Wayfarer mobile communications unit. The two-way satellite-based mobile communications system is compatible with the company's one-way satellite-based communications system, which has been in use since June 1988 and is used by more than 50 trucking fleets.

Sony's system relies on the Geostar satellite relays and central earth station.

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Circle (48) on Fast Fact Card



ground communications links to fleet headquarters and computerized mapping software.

The two-way system is capable of providing positioning and messaging information. The unit enables remote monitoring and control of a variety of truck functions such as adjusting a vehicle's refrigeration or shutting off a truck's engine.

The 2-Wayfarer unit includes a cab-mounted keyboard and display, antenna system and two "black box" processors. It comes in two versions: one as an upgrade to current one-way users and as a new product.

Sony's satellite tracking and message system is installed in the LiMOUSEine vehicle of Walt Disney World, Lake Buena Vista, FL.

### **Credit cards valid for Quintron parts**

Quintron, Quincy, IL, accepts Visa and MasterCard payments for purchases of up to \$5,000 worth of parts and accessories. Quintron processes the charges and encloses the appropriate receipt with the parts shipment. The Quintron parts hotline is 800-637-9181.

### **Calais Repair Service reaps \$512,500 shared contract**

Calais Repair Service, Lafayette, LA, has been awarded a shared contract worth more than \$512,500 to upgrade the St. John the Baptist parish government at LaPlace, LA. The upgrade includes a repeater system, dispatch consoles, communications center equipment, an 800MHz trunked system and a vehicle tracking system.

### **Avtec reaps contracts for dispatch console system**

Avtec, Gilbert, SC, has garnered contracts for its ACCESS (Advanced Concept Communications Exchange and Signaling System) touch-screen controlled integrated radiotelephone dispatcher control system.

Contracts include:

- *AT&T*—three systems for control of maintenance fleets in Virginia, Georgia and the greater Kansas City, MO, area.
- *Tinker Air Force Base*—one system for classified purposes.
- *Consolidate Rail Corporation*—one

system for Indianapolis, marking the fifth ACCESS system installed for Conrail.

The contracts exceed \$1.5 million and are scheduled for delivery and installation this year.

The dispatcher control system features one-touch control of radiolines, PBX lines, multifunction paging, intercom and autodial directories.

### **Maxon appoints Canadian distributor**

Maxon Electronics, Kansas City, MO, has appointed Omni Provincial Electronic (OPEI) as its Canadian distributor for land mobile radios and accessories. OPEI is at 6 Vata Court, Unit 2, Aurora, Ontario L4G 4B6; 416-841-6740.



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## THE HOT TIP

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## News

## SEA names top sales rep

SEA, Mountlake Terrace, WA, has named Richard Moses of R.P. Moses & Company, Bellmore, NY, as its salesperson of the year.

## Selectone presents sales awards

Selectone, Hayward, CA, presented sales awards for fiscal year April 1, 1988 to March 31, 1989. Awards went to Cartwright Communications Company, Cincinnati, for "Distributor of the Year"; Curry Sales, Overland Park, KS, for "Rep of the Year" and "Best % Increase—Rep"; Jescom Communications International, San Mateo, CA, for "Exporter of the Year"; Selectone Australia, Burleigh Heads, Queensland, Australia, for "Export Distributor of the Year"; and Jan Industrial Electronics, Philadelphia, for "Best % Increase—Distributor."

## Quartz crystal supplier enters land mobile market

Elenex has entered the land mobile market as a supplier of quartz crystals for hand-helds and mobiles. The company plans to become a major supplier to dealers. Elenex is at 7 Wayland St., North Cohocton, NY 14868; 800-356-8433.

## Regency purchases M/A-COM group

Regency Electronics, which assumes the name Relm Communications this month, has purchased the Land Mobile Communications Product Group from M/A-COM, Merrimack, NH. The purchase price was not disclosed.

The M/A-COM group makes cavity filters, isolators, receiver multicouplers, transmitter multicouplers and multiplex antenna systems. Indianapolis-based Relm will relocate the manufacturing of the product group to its West Melbourne, FL, facility.

According to M/A-COM officials, the product line group was for sale because it is peripheral to its main business of defense electronics products and systems.





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It's the complete R.C.C. central office, and the most flexible.

- It's compatible with IMTS, IPTS, DTMF, G.E. MARC V, and SMART signaling.
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## Association of Communications Technicians debates handbook issue

During a March 1989 meeting, Association of Communications Technicians (ACT) leadership council members considered revisions and uses for the *NABER Technician Certification Examination Handbook*.

The handbook offers sample questions and answers to help candidates to prepare for the National Association of Business and Educational Radio (NABER) technician certification exam. ACT is a membership section of NABER.

NABER's technician certification advisory committee plans to make changes in the exam questions that will necessitate a revision of the handbook.

During a discussion of the handbook, council chairman Ian Wright of Dominion Communications Systems, Chester, VA, raised the subject of using the handbook during the hiring process. He said the handbook could be used to acquaint prospective new technicians with the work conducted by most radio com-

munications service facilities.

Council member Alan Haley of Master Electronic Systems Associates, Tacoma, WA, said: "The handbook will scare applicants for sure because its information is so specific to the two-way radio industry. Applicants with the right education and who otherwise *could* succeed with on-the-job training might be discouraged by the handbook."

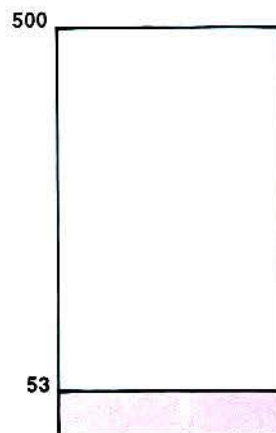
Council member Joseph Gately of Gately Communication, Hampton, VA, said: "Many of my employees get the handbook to test the water on the NABER certification exam."

According to chairman Wright, "The handbook is a decided advantage."

### Information

For information about ACT, call 800-759-0300. Ask for "technician services."

### ACT membership drive



During its March 1989 council meeting, ACT set a goal of adding 500 new members during the following 12 months. As of June 15, 53 new members have joined.

MBT

## SensaTemp Soldering and Desoldering, the "Dynamic Duo" from PACE.

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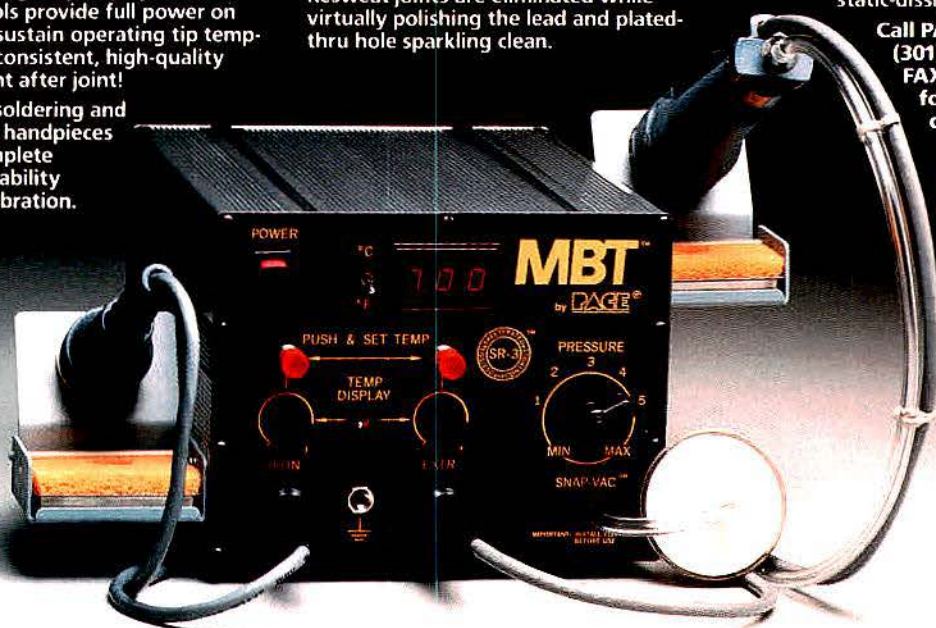
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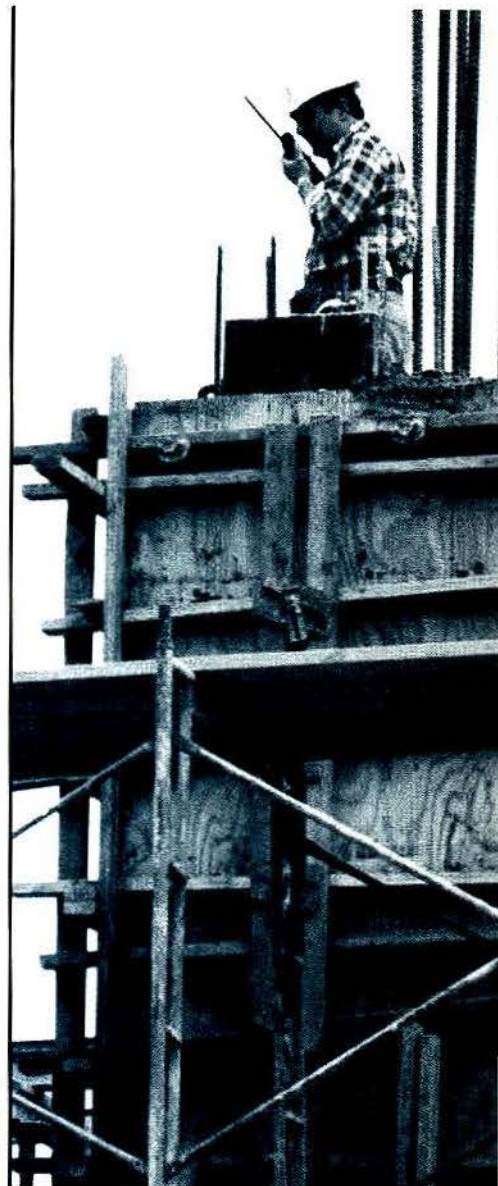
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# Larsen keeps you on top of the job.

Keeping a project on schedule and on budget requires clear, precise communication. And that's a job for Larsen.

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Circle (56) on Fast Fact Card

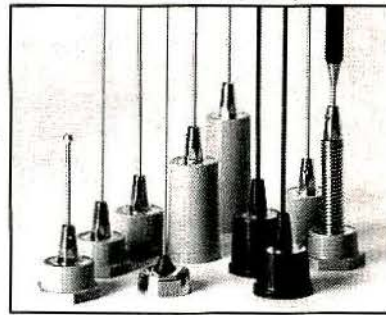
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## New products

### Hand-held tone programmer

The HHP-1 hand-held programmer from **Communications Specialists** programs tones into an IC-110 microcircuit's electronic memory. The IC-110 is used in the company's tone signaling equipment to offer a choice of tones previously available only in tunable equipment. It combines accuracy, stability and tone selection convenience.

The ability to change the IC-110's memory allows a service technician to choose any non-standard tone frequency for special applications. Customizing the tone arrangement allows one tone unit to control multiple switching without the need for diode network circuitry.

Using the HHP-1, a technician can select and program tones into the IC-110



while in the shop or in the field. The HHP-1 programs, reprograms, reads and erases any 32 frequencies from 0.1Hz to 6,550Hz in 0.1Hz steps. Thus, the IC-110 may be used for many analog tone signaling formats and for special applications that require accurate tone generation. Once programmed, the IC-110 installs into the tone board, and working tones are accessed through DIP switch programming.

The HHP-1 operates on a 9V battery. A plug-in socket is provided for an external power source.

Circle (375) on Fast Fact Card



## What happens when you call your radio base station and the only one attending it is Tiger?

Nothing, probably. You don't get a response.

Tiger can hear you, but he can't answer.

You need the ST-40 Hyperdyne Radio/Telephone Interface by Selectone.

The ST-40 Hyperdyne offers a unique new way to control a two-way radio base station. Now, every telephone in your office can serve as a remote link to your two-way radio using your existing telephone system.

Not to be confused with a phone patch or interconnect device, the ST-40 Hyperdyne is an electronic interface which connects a radio base station to any multi-line office telephone system.

The ST-40 Hyperdyne allows a mobile unit to ring the office telephone system when the radio base is attended only by someone like Tiger.

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You need the ST-40 Hyperdyne Radio/Telephone Interface by Selectone. It's a good system to have when "meow!" isn't enough of a response.

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Circle (57) on Fast Fact Card

### Voice amplifier unit connects to portables



The Loudmouth communications unit connects to portables to amplify communications. The user's voice is transmitted from the unit's throat mic to its voice amplifier. Incoming radio messages are heard through the unit's speaker. A 9V battery powers the Earmark unit.

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SRL-501R3 CE

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The smallest package in the market, this compact (height 2.28 in. (58 mm) to 3.15 in. (80 mm) X 9.3 in. (236 mm) diameter) diversity antenna has almost unlimited applications in the data mobile radio market as well as cellular, automated train control and upband trunking operating in the 824 - 1400 MHz range.



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The Compact SRL-440  
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Measuring 10.5 in. (267 mm) long by 2.5 in. (64 mm) wide and weighing only 2.5lb. (1.12 kg), this antenna operates in the 928 to 956 MHz band.

The 440 is excellent where reliable data transfer is essential. It's ideal for multi-point systems, point-to-point and receive sites.... anywhere you might use a yagi.... and it's more economical!

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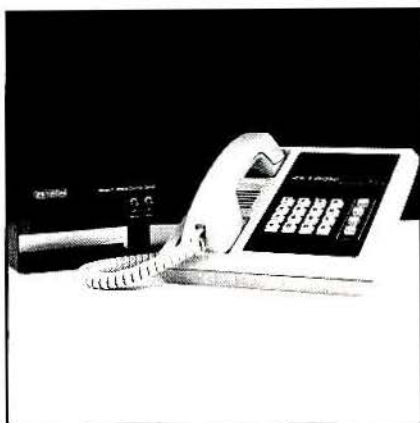
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Circle (59) on Fast Fact Card

**New products****Cellular portable antenna  
provides built-in 'elbow'**

The AM850RA half-wave flexible cellular portable antenna from **Valor Enterprises** has a built-in solid brass right angle elbow and TNC fitting. The 3dB antenna is omni directional.

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**Selective calling system**

Fast frequency-shift keying (FFSK) in an 80ms burst contains all the selective calling information that requires two to three seconds to send via DTMF signaling. The protocol includes error-detection and automatic retry. **Zetron** features FFSK in its model 7 mobile control center and model 7D dispatch control center.

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When you need replacement batteries for your 2-way radios and paging equipment, depend on high quality Jabro batteries to keep your system running smoothly. All of these nickel-cadmium batteries are American made and are shipped factory fresh for maximum power and long service life.

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Circle (62) on Fast Fact Card

## New products

### Two-channel portable comes in VHF, UHF versions

The HT10 Handie-Talkie two-channel portable made by Motorola is available in VHF and UHF. It comes in 2W and 5W models for use in the 150.8MHz to 162MHz range and 2W and 4W models for the 450MHz to 470MHz range.

Circle (444) on Fast Fact Card

### Voice storage unit interfaces mobiles

The Shinwa ZX126 voice storage system interfaces with most brands of mobiles, including the company's X series. The unit stores 64 seconds of incoming messages and allows users to leave a message for callers.

Circle (455) on Fast Fact Card

### Paging message center offers 14 phone line inputs



The PS-9000 PageSure paging message center has a 10,000 code capacity—depending on the paging terminal used—and offers 14 telephone line inputs. The Reach Electronics' unit works with all types of pagers and stores messages that can be retrieved by phone at user's convenience. The center time-stamps and date-stamps stored messages and enables password protection. Numeric pages are converted to voice when retrieved. The unit permits priority pages, group pages, personal reminder pages and repeat pages. It adds voice store and forward to existing terminals.

Circle (469) on Fast Fact Card

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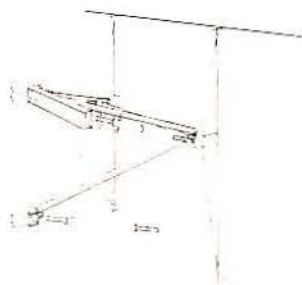
# New from Microflect! Antenna Support Structures and Passive Reflectors for your 18 and 23 GHz Microwave Systems.

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**Monopoles:** Because of the aesthetics considerations, this structure is a solution often preferred by Architectural Review Boards or city council members. Our monopole is available as a standard product in heights of 10', 15', 20', 25', and 30'. Custom heights are available on special request.

**Tripods:** As with monopoles, aesthetics are often a consideration for the selection of tripods. These structures are designed for roof mounting and are engineered for 100 mph (40 psf) winds. Five models are available ranging from 6' to 20' in height.

**Standoff Wall Mounts:** Standoff Wall Mounts offer several advantages over regular wall mount units. They



allow 140° of azimuth adjustment, permitting more versatility in locating an installation position for the antenna. They also incorporate a work platform and an optional wall-mounted access ladder.

**Wall Mounts:** These units can be specified for corner mounting or flat

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ENABLE YOU TO  
CIRCUMVENT MAN-MADE  
OR NATURAL OBSTACLES  
THAT ARE IN YOUR  
SIGNAL PATH LINE OF  
SIGHT. REFLECTORS CAN  
BE MOUNTED ON ROOFS  
OR WALLS OF BUILDINGS,  
OR ON OTHER SUPPORT  
STRUCTURES.

wall mounting applications. A cantilever wall mount is also available for sighting over parapet walls.

**Roof Mounted Frames:** These frames are ideal when there is an immediate need to get antennas in service. Microflect's Roof Mounted Frames feature these benefits:

- Short lead times for delivery
- Minimal installation time after delivery
- Frames are complete with step bolts for climbing

**Passive Reflectors:** If your communications system plan has man-made or natural line-of-sight obstacles, we can show you how to get around them economically and effectively. Our reflectors enable you to redirect your signal path around obstacles without employing

costly active repeaters.

For more information, please contact us and request a free copy of our new 18-23 GHz Antenna Support Structure and Reflectors catalog. Contact Microflect Co., Inc., 3575 25th St. SE, P.O. Box 12985, Salem, OR 97309-0985, Telephone (503) 363-9267, FAX (503) 363-4613.



3575 25th Street SE • P.O. Box 12985  
Salem, Oregon 97309-0985 U.S.A.  
(503) 363-9267 • TLX 510-599-0107  
FAX (503) 363-4613

SELF-SUPPORTING TOWERS • CUSTOM TOWERS • LIGHT-WEIGHT TOWERS • GUYED TOWERS  
MICROWAVE PASSIVE REPEATERS • WAVEGUIDE SUPPORT SYSTEMS • TOWER ACCESSORIES • TOWER HARDWARE



# Untenna™

90% Shorter than  
quarter waves yet  
performs better than  
whip antennas!



**Avoid This      With This**

CR109A • Design frequencies  
from 27-85 MHz •••••

Tests prove it! The Untenna outperforms whip antennas many times its height, and puts out an omnidirectional, vertically polarized signal with higher "Q" and less intermod!

Other Untennas available from  
115 to 500 MHz; write for details.

COM-RAD INDUSTRIES  
P.O. Box 554  
Grand Island, NY 14072-0554  
(716) 773-1445

Distributor Inquiries Invited

Circle (65) on Fast Fact Card

## New products

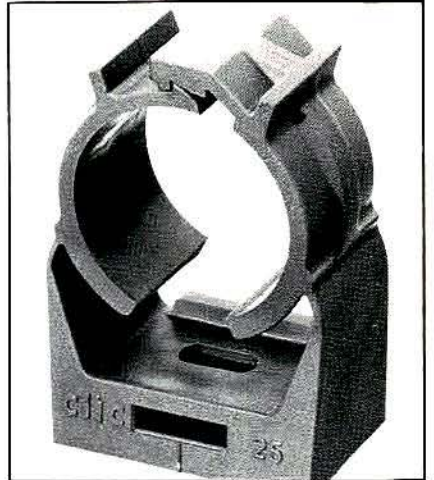
**Hand-held frequency counter  
covers 10Hz to 2.2GHz**



Model 2210 hand-held frequency counter from **Optoelectronics** features low-frequency coverage to 10Hz and microwave coverage of more than 2.2GHz. It includes internal nicad batteries and oscillators with a precision quartz time base. Two-hour battery operation is typical after a 16-hour recharge.

Circle (380) on Fast Fact Card

**Self-locking hangers  
fit coaxial cable line**



Self-locking hangers are available for slotted coaxial cable. The **Andrew** hangers fasten without straps and screws. The hangers come in kits of 10 and are available in sizes for all cable applications.

Circle (470) on Fast Fact Card



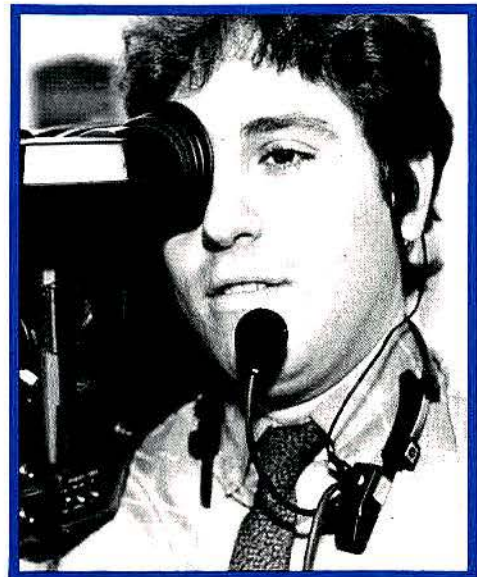
## WHEN YOU NEED THE BEST... AND KNOW THE DIFFERENCE

You bought your radio to communicate.  
DTC accessories let you talk where you work.  
In high noise, wearing protective clothing,  
or when both hands need to be free.

DTC offers the most complete line of  
communication accessories available  
in the 2-way radio industry.

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(FORMERLY CONTROLONICS CORPORATION)



**RHS-4**  
*Lightweight Headset*

Circle (66) on Fast Fact Card



Soar with Decibel!



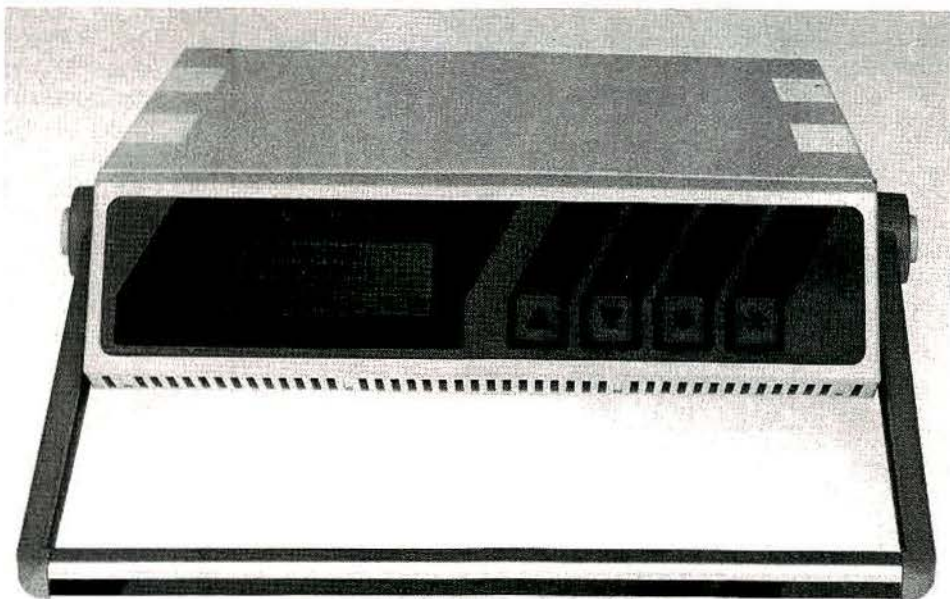
# NEW

## From Decibel!



If you want quality, you want Decibel!  
Leadership since 1947.

Now  
only  
\$3,995



## Compare Cel-Tel™ Tester and save!

New, DB1965 Cel-Tel Tester provides automatic testing for cellular mobile, portable and transportable telephones. At the workshop or customer's vehicle!

### Quick and easy to use!

Connect the Tester to the phone's antenna connector and select a complete range of tests via push-buttons.

Results appear on the LCD display.

The Tester has internal battery and battery check, 4-button keypad and 4-line, 20-character LCD. It provides a continuity test with an audible alarm. Carrying case and portable printer are optional.

### Order now!

The tester is made in the U.K. by Smith Myers Communications. Decibel holds exclusive rights for North America.

Order DB1965 Cel-Tel Tester from Decibel's Authorized Factory Warehouses, listed below, or contact Marketing, Decibel Products, Inc., P.O. Box 569610, Dallas TX 75356-9610. Telephone (214) 631-0310. Telex 73-0212. FAX (214) 631-4706.

Decibel is a Business Unit of  
Alliance Telecommunications Corporation.

Testers Available Price	DB1965 Cel-Tel \$3,995 List Price	Competitor X About \$14,000 more	Competitor Y About \$8,000 more
Portable	8 pounds	50 pounds	40 pounds
Additional Unit Required	No	Yes	No
Trained Technician Required	No	Yes	Yes
Auto Test	Yes	Yes	Yes
Manual Test (RF)	Yes	Yes	Yes
RS232C Interface	Yes	Yes	Yes
Amps Interface	No	No - Optional	Yes
Tests Display	Yes	Yes	Yes
Applications Software	No	No	Yes
Power Levels Check	Yes*	Yes	Yes
Tx (Frequencies) Check	Yes (internal)	Yes	Yes
Sat Tones Check	Yes 6 KHz internal	Yes	Yes
Sat Deviation + -	Yes $\pm 1.7$ KHz $\pm 10\%$ internal	Yes	Yes
St Tones Check	Yes $\pm 6.4$ KHz internal	Yes	Yes
Maximum Deviation	Yes audio deviations max $\pm 12$ KHz $\pm 10\%$	Yes	Yes
Rx Sensitivity 12 dB 20 dB	Yes @ -107 dBm Yes @ -107 dBm	Yes Yes	Yes Yes

\*Needs external watt meter.

**Factory Authorized Warehouses:** Tekcom, Inc., Costa Mesa and Union City CA; Talley Electronics Co., Hayward CA; Santa Fe Springs CA and Phoenix AZ; CW Electronics, Denver CO; The Antenna Farm, Overland Park KS; M. Hutton Co., Dallas TX; Cartwright Communications Co., Cincinnati OH; ComMar, Inc., Westport MA; Tessco, Inc., Hunt Valley MD; Tampa FL; Schaumburg IL; and Sparks NV; Primus Electronics Corp., Joliet IL; Marketronics, Sunrise FL; Lenbrook Industries, Ltd., (Canada) St. Leonards, Quebec; Calgary, Alberta, and Pickering, Ontario.

Circle (67) on Fast Fact Card



# BE HEARD THROUGH THE NOISE.



## When clear communication counts,

ADCO Industrial Intercoms break through the toughest problems — high ambient noise and harsh environments.

Because normal voice levels penetrate clearly, this is the perfect communication system for areas of high noise.

The system easily tolerates high temperatures and rough handling. Solid state components are protected against corrosive fumes, dirt, rain, or salt water. Each unit is sealed in a heavy-duty submergence-proof aluminum enclosure.

Special options: hands-free remote, lightning protection, extreme low temperature operation, plus many others. Easy multi-station installation.

Creating dependability since 1958, ADCO conquers noise.

Call or write for prices and complete information.

## ATKINSON DYNAMICS

10 West Orange Avenue  
South San Francisco, CA 94080, (415) 583-9845  
A division of Guy F. Atkinson Company

**Without a shout, without a doubt.**

See us in  
Sweet's Cat &  
Thomas Reg.

Circle (68) on Fast Fact Card

# OUR COMPLEMENTS TO YOUR RADIO



OUR complete line of accessories enables use of portable or mobile radios in virtually any situation. We have extensive experience in solving communication problems — from the routine to the extremely difficult . . . and it's all available to you. Simply contact us.

SOUND IDEAS FROM

**Setcom**  
CORPORATION

1400 Stierlin Road  
Mountain View, CA 94043  
415/965-8020

Circle (69) on Fast Fact Card

## New products

### 'GE' replacement batteries

Alexander Manufacturing makes replacement batteries for GE MPD, PLS and TPX portables:

☐ Model R8503 7.5V 800mAh replaces GE model 19A704850P3.

☐ Model R8507 7.5V 1.2Ah replaces GE model 19A704850P7.

☐ Model R8603 7.5V 1.3Ah replaces GE model 19A704860P3.

☐ Model R8607 7.5V 1.7Ah replaces GE model 19A704860P7.

Alexander offers an alkaline version for GE MPD, PLS and TPX radios:

☐ Model A4870 10.5V 4.4Ah.

The mercury version of these batteries is:

☐ Model M4870 9.8V 4.8Ah.

Circle (333) on Fast Fact Card

### Slotted coaxial cable line expands, includes upgrades



The slotted coaxial cable line by Andrew includes four new cables of 1/4-inch, 3/8-inch, 1 1/4-inch and 1 5/8-inch cables. The 1/4-inch and 3/8-inch cables feature low-coupling loss. The 1 1/4-inch and 1 5/8-inch cables offer low attenuation at high frequencies. Improved electrical performance and direct connector attachment are upgrades for new versions of the 1/2-inch and 7/8-inch cables.

All sizes of cable can be ordered with a fire-retardant, halogen-free jacketing that uses insulated barrier tape. The cable has low smoke and toxicity emission characteristics.

Circle (467) on Fast Fact Card



# Antenna Specialists



**1-3 Day Delivery  
Nationwide!**

**Call Cartwright**

**800-543-8614 • In Ohio 800-582-2641**



**CARTWRIGHT**  
COMMUNICATIONS COMPANY

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Circle (70) on Fast Fact Card

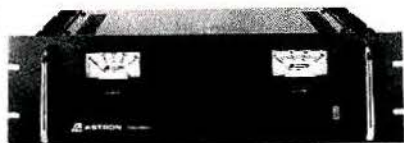




MODEL VS-50M

- HEAVY DUTY • HIGH QUALITY • RUGGED • RELIABLE •
- RS, RM and VS SERIES**
- SPECIAL FEATURES**
  - SOLID STATE ELECTRONICALLY REGULATED
  - FOLD-BACK CURRENT LIMITING Protects Power Supply from excessive current & continuous shorted output.
  - CROWBAR OVER VOLTAGE PROTECTION on all Models except RS-4A, RS-5A.
  - MAINTAIN REGULATION & LOW RIPPLE at low line input Voltage.
  - HEAVY DUTY HEAT SINK • CHASSIS MOUNT FUSE
- THREE CONDUCTOR POWER CORD
- ONE YEAR WARRANTY • MADE IN U.S.A.
- PERFORMANCE SPECIFICATIONS**
  - INPUT VOLTAGE: 105 - 125 VAC
  - OUTPUT VOLTAGE: 13.8 VDC  $\pm$  0.05 volts (Internally Adjustable: 11-15 VDC)
  - RIPPLE: Less than 5mV peak to peak (full load & low line)
  - Also available with 220 VAC Input Voltage

### RM-A SERIES



MODEL RM-35M

### 19" X 5 1/4" RACK MOUNT POWER SUPPLIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping WL (lbs.)
RM-12A	9	12	5 1/4 x 19 x 8 1/2	16
RM-35A	25	35	5 1/4 x 19 x 12 1/2	38
RM-50A	37	50	5 1/4 x 19 x 12 1/2	50
• Separate Volt and Amp Meters				
RM-35 M	25	35	5 1/4 x 19 x 12 1/2	38
RM-50 M	37	50	5 1/4 x 19 x 12 1/2	50

### RS-A SERIES



MODEL RS-7A

RS-4A	3	4	3 3/4 x 6 1/2 x 9	5
RS-5A	4	5	3 1/2 x 6 1/2 x 7 1/4	7
RS-7A	5	7	3 3/4 x 6 1/2 x 9	9
RS-10A	7.5	10	4 x 7 1/2 x 10 3/4	11
RS-12A	9	12	4 1/2 x 8 x 9	13
RS-20A	16	20	5 x 9 x 10 1/2	18
RS-35A	25	35	5 x 11 x 11	27
RS-50A	37	50	6 x 13 3/4 x 11	46

### RS-M SERIES



MODEL RS-35M

• Switchable volt and Amp meter				
RS-12M	9	12	4 1/2 x 8 x 9	13
• Separate volt Amp meters				
RS-20M	16	20	5 x 9 x 10 1/2	18
RS-35M	25	35	5 x 11 x 11	27
RS-50M	37	50	6 x 13 3/4 x 11	46

### VRM/VS-M SERIES

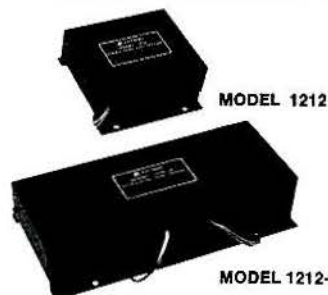


MODEL VS-35M

• Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts				
• Current limit adjustable from 1.5 amps to Full Load				
	@ 13.8VDC @ 10VDC @ 5VDC		@ 13.8V	
VS-20M	16	9	4	20
VS-35M	25	15	7	35
VS-50M	37	22	10	50
• Variable rack mount power supplies				
VRM-35M	25	15	7	35
VRM-50M	37	22	10	50

\*ICS—Intermittent Communication Service (50% Duty Cycle 5 min. on 5 min. off)

## DC-DC CONVERTERS



MODEL 1212

MODEL 1212-18

### MODEL 1212 & 1212-18 Switching Regulated Converter.

Designed for FM transceivers and other applications requiring 12 volt power source converted from 12 volt positive ground battery. Regulation with pulse width modulation at 20 KHz. Input—12V DC (Positive ground only). Functional from -11 V DC to -16 V DC. Output +13.8 V DC (Negative ground only).

	1212		1212-18	
Output Voltage	13.8 V DC	$\pm$ 2 V DC	13.8 V DC	$\pm$ 2 V DC
Line/Load Regulation	200 mV		200 mV	
Ripple/Noise	50 mV RMS		50 mV RMS	
Current Continuous	6 Amp		14 Amp	
Current (ICS)	9 Amp		18 Amp	
Current Limit	12 Amp		19 Amp	
Case	2 3/4" (H) x 6" (W) x 6" (D)		2 3/4" x 6" x 12"	
Shipping Weight	2 lbs.		4 lbs.	



MODEL 2412

MODEL 2412-16

### MODEL 2412 & 2412-16 Switching Regulated Converter.

Designed for FM transceivers and other applications requiring 12 volt power source converted from 24 volt battery. Regulation with pulse width modulation at 20 KHz. Input +28 V DC (Negative ground only). Functional from +22 V DC to +32 V DC. Output +13.8 V DC (Negative ground only).

	2412		2412-16	
Output Voltage	13.8 V DC	$\pm$ 2 V DC	13.8 V DC	$\pm$ 2 V DC
Line/Load Regulation	200 mV		200 mV	
Ripple/Noise	50 mV RMS		50 mV RMS	
Current Continuous	9 Amp		16 Amp	
Current Limit	12 Amp		20 Amp	
Case	2 3/4" (H) x 6" (W) x 6" (D)		2 3/4" x 6" x 12"	
Shipping Weight	2 lbs.		4 lbs.	

ALSO! AVAILABLE AS MODEL 3612 & 3612-16: +36 V DC (Negative ground only) AND AS MODEL 4812 & 4812-16: +48 V DC (Negative ground only).



## New products

### SWR, power meter suits 800MHz to 900MHz bands



The CM-900 from NCG Company is a compact SWR and power meter that fits mobile installations in the 800MHz to 900MHz bands. Maximum power is 120W. Other mini meters are available for VHF, UHF and 1,300MHz.

Circle (156) on Fast Fact Card

### Wattmeter calibrates 50Ω coaxial transmission

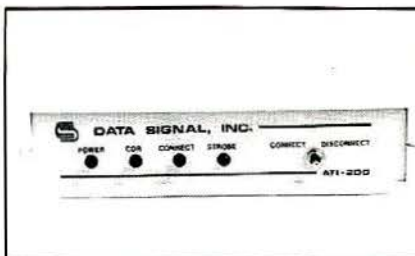


Model 4314B portable peak reading wattmeter uses two 9V batteries for as much as 20 hours of use; an ac adapter plugs into the unit as well. The Bird Electronic meter measures 50Ω coaxial transmission with an LED indicator for peak operation. Features include CW and peak operational mode switch and a battery test switch. The unit comes with two female N connectors. The meter's maximum insertion VSWR is rated at 1.05MHz to 1,000MHz, 1.1MHz to 2,300MHz. The wattmeter weighs 3 pounds.

Circle (461) on Fast Fact Card

### Interconnect 'regenerates'

The ATI-200 telephone interconnect regenerates DTMF signaling and converts dialing pulses. The Data Signal unit offers a choice of half-duplex, full-duplex and simplex modes with multidigit access, automatic ringout, a multifunction auxiliary relay and the capability to answer incoming rings automatically.



Circle (344) on Fast Fact Card

## Kantronics TM-1200™ REMOTE DATA AT A PRICE THAT'S IN REACH.

### REMOTE SITES, RUGGED TERRAIN CHECK DATA FROM THE OFFICE OR CARPHONE

#### WITH COMPACT, ERROR-FREE PACKET DATA TECHNOLOGY

Remote data acquisition,  
SCADA, and polling were  
never so easy, versatile or  
accurate...

With a Kantronics TM-1200™  
Telemetry Modem, you don't  
need a rack-mount to have  
high-performance.

#### Size Advantage

A TM-1200 is only 2"x6"x9". But it  
performs in small places like large  
expensive systems. So you can make  
sophisticated remote data and  
electronic checks in places you  
couldn't until now.

#### Error-Free

Packet communications are  
completely reliable.

#### Monitor, Control Nearly Anything

TM-1200 is 4-20ma sensor  
compatible. Check flow rates, make  
remote electronic checks, monitor  
Change Of State, even broadcast  
acquisition programs.

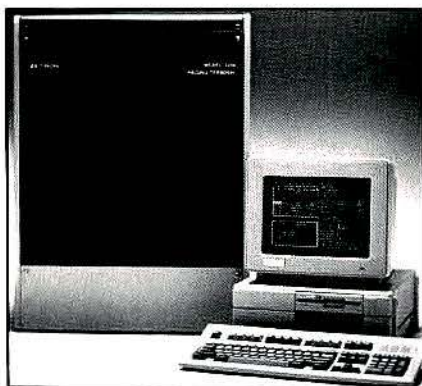
Kantronics 1 (800) 634-3308

Circle (72) on Fast Fact Card



## New products

### Paging accounting package



Page Accountant is a billing package that works with Zetron model 2100 and model 2200 paging terminals. It provides a PC-compatible program that produces monthly invoices and customer statements automatically. It produces a sales journal, a cash-receipts journal and an adjustments journal, as well as handling general ledger posting information.

Circle (358) on Fast Fact Card

### Dispatchers can configure radios to change codes

The Controller I, II and III radios incorporate basic encryption and computer-aided dispatch. The Bendix/King UHF and VHF radios operate with the user's present base station and repeater without modification. Dispatchers can configure the radios to change groups and encryption codes and can poll units for status.

Circle (465) on Fast Fact Card

### Base station interface

The Avtec base station interface unit provides access to multiple base stations in a "party line" arrangement over a single voice channel. With a dedicated line, it may be used as a base station controller. The unit supports popular multidrop protocols and works with existing systems. New multidrop systems may use a special code that adjusts signaling speed automatically, according to the quality of the voice channel.

Circle (374) on Fast Fact Card

### Handset sends DTMF signals



Bramco's model 2994 DTMF Smart-Mic handset gives the user a lot of feedback:

- ☐ Its illuminated keypad gives tactile feedback.
- ☐ The mic produces a sidetone to verify transmission of DTMF tones.
- ☐ As buttons are pressed, the transmit ready light brightens.

Circle (348) on Fast Fact Card

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With an expanding line, improved quality, next day shipping, competitive pricing and the friendliest service.

**We are working harder than ever for you!**

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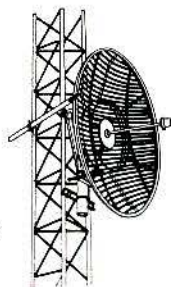
Circle (73) on Fast Fact Card

## THE ANTENNA SOURCE

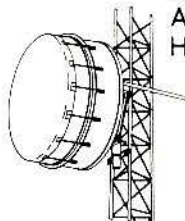
40 Years As The Leader In Antenna Development

### GRID ANTENNAS

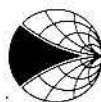
- \* 335 - 2700 MHz
- \* 125 M.P.H. Survival
- With 1/2" Radial Ice
- \* Pressurized & Non-Pressurized
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- \* Split Reflectors Available
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- With 1/2" Radial Ice
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- \* Very High Front To Back
- \* High Gain
- \* Low Side Lobes
- \* Low VSWR



**Radiation Systems, Inc.**  
**Mark Antennas Division**

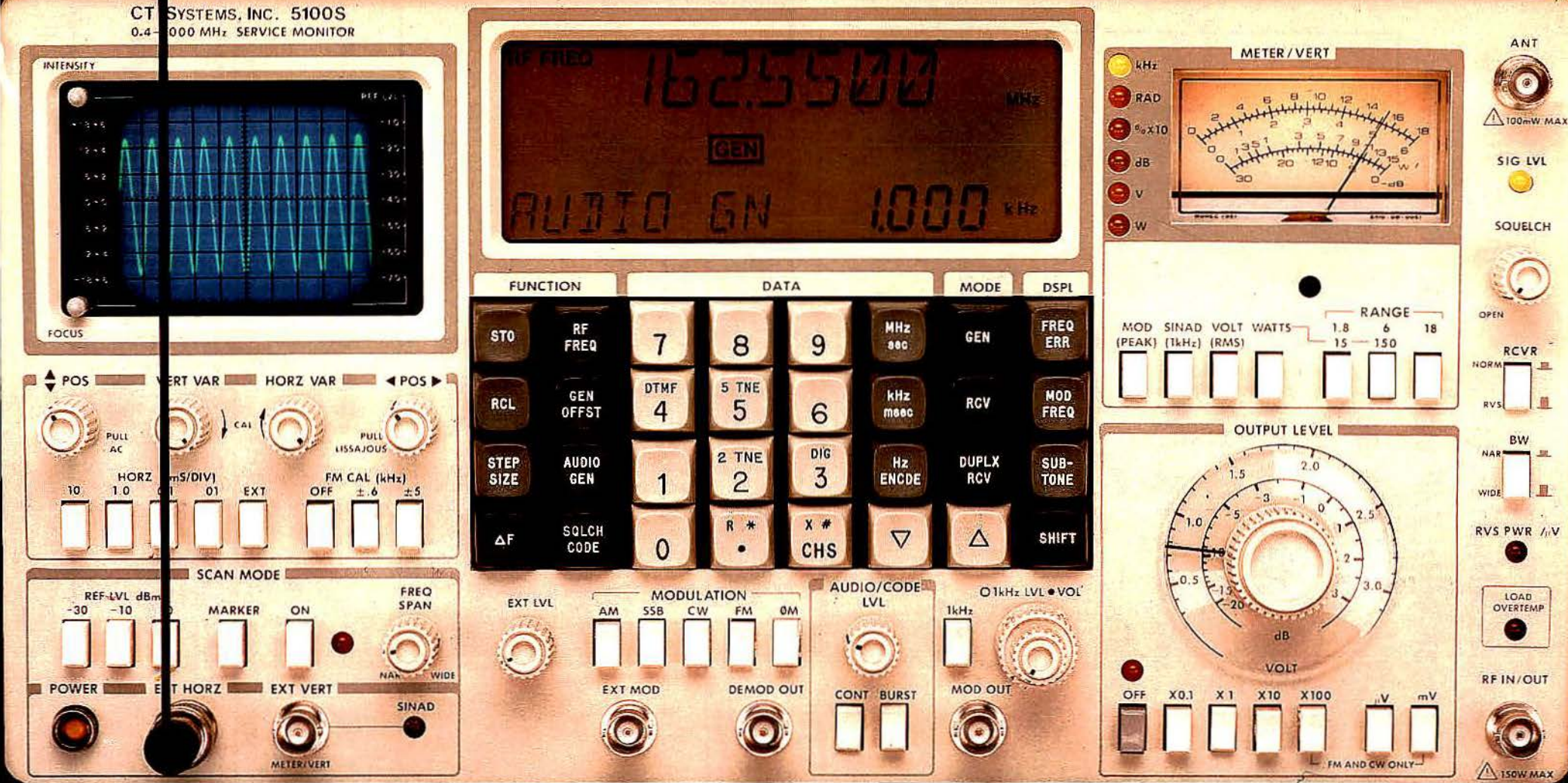
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Circle (74) on Fast Fact Card



CT SYSTEMS, INC. 5100S  
0.4-1000 MHz SERVICE MONITOR



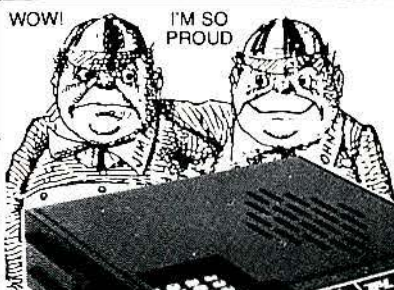
## What's Wrong With This Picture?

**Model 5100**  
**Service Monitor**  
**\$8795**

- Spectrum Analyzer
- True Full Duplex/Offset Generator
- Tone and Digital Encoder/Decoder
- Storage and Recall Registers
- Built-In Self Diagnostics
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## MOBILE ADAPTER for the 800 MHz, UHF and VHF King Portable **NOW WITH DTMF ACCESSIBILITY!**

### FEATURES:

- Built in RF amplifier 12 watts-800 MHz • 20 watts UHF
- Built in audio amplifier
- External audio jack
- VHF 35
- Fast charger
- All connections made with one sliding lever
- Keylock for security
- Constructed to complement the King Radio line
- Complete with microphone and mounting bracket

Leadership by Tradition

talk  
power  
by

**TPL**

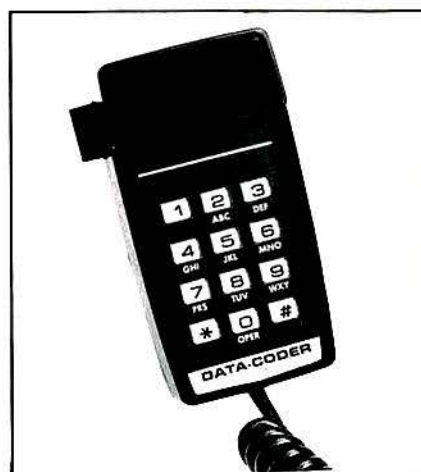
COMMUNICATIONS, INC.

3336 San Fernando Road, Los Angeles, CA 90065  
(213) 256-3000 • 800 HI POWER • TWX 910 346 7015  
FAX (213) 254-3210

Circle (76) on Fast Fact Card

## New products

### Backlit DTMF encoder mic

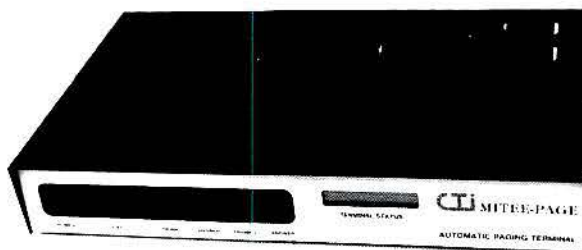


The Data-Coder 60 backlit DTMF mic mutes and keys PTT when a button is pressed. A two-second hold time keeps the transmitter keyed during dialing. The Data Signal mic has raised buttons with sealed switches that give the user tactile feedback.

Circle (345) on Fast Fact Card

# WE DID IT AGAIN!

CTI Introduces the Small but Mighty "MITEE-PAGE"  
Small System Automatic Paging Terminal



### FEATURES INCLUDE:

- 1000 Call Capacity
- 100% Random Programming
- Analog, all formats or
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- 16 Character LCD display monitor
- 2 input trunks, end to end or DID field strappable
- Field software upgrade ease
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- Timed Station ID (MCW)
- Numerous other features with more to come

**GIVE DOUG, TRAVIS OR JIM A CALL FOR ADDITIONAL INFORMATION**



**CTI Inc.**

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FAX 601-287-9427

Circle (77) on Fast Fact Card





## NOW THERE'S A TRUNKED RADIO SYSTEM WITH FEATURES THAT FAR OUTWEIGH ITS PRICE.

There's nothing that says your customers have to buy enhanced trunked radio systems with heavy price tags.

That's why E.F. Johnson developed Multi-Net™ LTR®, the first *affordable, growable* trunking system.

And now E.F. Johnson, with the help of AmeriCom, offers automatic wide-area communications. Not only is this networking system easy to manage, it also provides

increased incremental income from long-range communication users while quickly recovering your initial investment. To find out how the Johnson/AmeriCom Alliance will benefit you and your customers, call us at 1-800-328-3911, Ext. 380.



**JOHNSON**  
The Clear Leader In Trunked Radios

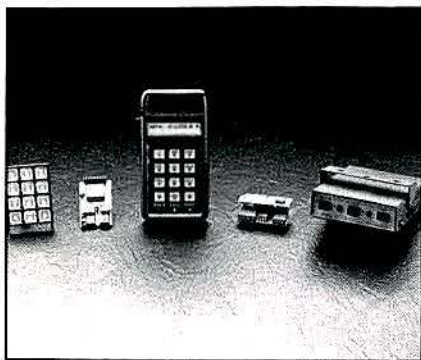
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Circle (78) on Fast Fact Card



## New products

### Voice scramblers offer 10,000 ID numbers



Programmable rolling code voice scramblers offered by **Midian Electronics** include 10,000 system ID numbers, keys for joint law enforcement operations and digitally controlled audio processing. The VPU-4K and VPU-5K fit King VHF portable and mobile radios; the VPU-4U and VPU-5U are for conventional portables; and the Mic-Coder-4 is a microphone version.

Circle (440) on Fast Fact Card

### Mobile data terminal offers programmable recall

The Digicom MDT-870 mobile data terminal offers 16,000 individual ID addresses and 125 group ID capability. The **ElectroCom Automation** terminal handles 14 customer-specific status conditions and has programmable function keys for recall of forms. The unit operates on conventional radio, and two versions are available for use on trunked systems. Model MDT-870T works on GE's public safety trunked radio system, the PST-16 Plus. Model MDT-870S operates on E. F. Johnson's LTR trunked system.

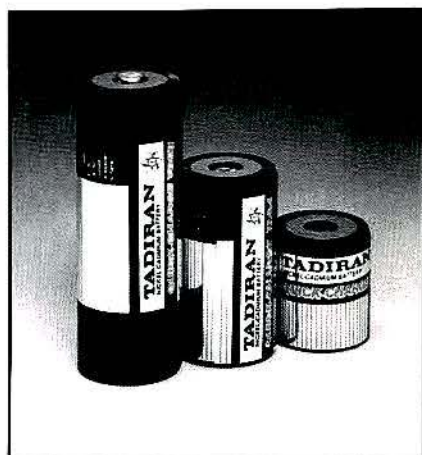
Circle (447) on Fast Fact Card

### Cellular mobile equipment

**Drive Phone's** LuxCel cellular product line includes the LXT 3700 trans-portable phone; LXM 5000 mobile phone; 11 cellular antennas; chargers; batteries; power supplies; inverters; and accessories.

Circle (337) on Fast Fact Card

### 'F' cell NiCd battery



The TDQ-7 'F' cell quick-charge NiCd battery made by **Tadiran** has 7Aj capacity and can be recharged in one to three hours.

Capacities for other Tadiran cells have been increased: the TDQ-2 1/2D cell's capacity is 2.2Ah; the TDQ-4 D cell's capacity is 4.3Aj.

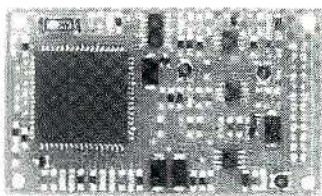
Circle (350) on Fast Fact Card

## GLB HIGH SPEED RADIO MODEM

The Model HSM-5 is a low-cost OEM subassembly for fast two-way data transmission via radio transceivers.

#### APPLICATIONS:

- TELEMETRY
- MONITORING
- REMOTE CONTROL
- ROBOTICS
- POINT-OF-SALE TERMINALS



#### FEATURES:

- 9600 AND 4800 BAUD DATA RATES
- UTILIZES FSK ON STANDARD VOICE CHANNELS
- COMPATIBLE WITH MOST VOICE AND DATA RADIOS: DIRECT FM, SYNTHESIZED & PHASE MODULATED
- LOW CURRENT DRAIN PLUS POWER-DOWN MODE
- ON-BOARD WATCHDOG TIMER
- FAST DCD OUTPUT FOR QUICK TURNAROUND TIME
- COMPATIBLE WITH MOST PACKET CONTROLLERS
- SMALL SIZE
- WEIGHS ONLY ONE OUNCE

Custom versions of the Model HSM-5 can be supplied for volume applications requiring smaller size, lower current drain, or wider operating temperature range.

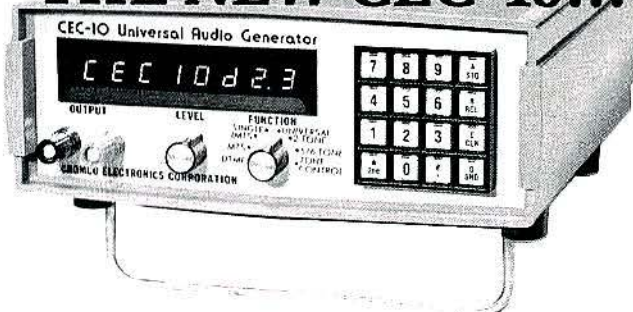
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#### FEATURES:

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DTMF, MTS, IMTS, 2-TONE, 5/6 TONE, HSC, SINGLE TONE (Continuous or dial pulsed), Tone Remote Control, and Motorola PURC™ Station Control.

##### DIGITAL

Motorola Golay-Sequential-Code (GSC), NEC D3 & D4, POCSAG, and Digital Coded Squelch.

##### NEW FEATURES

- Alphanumeric & High Speed POCSAG
- MICROLINK Digital Control Format.



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Circle (81) on Fast Fact Card



## New products

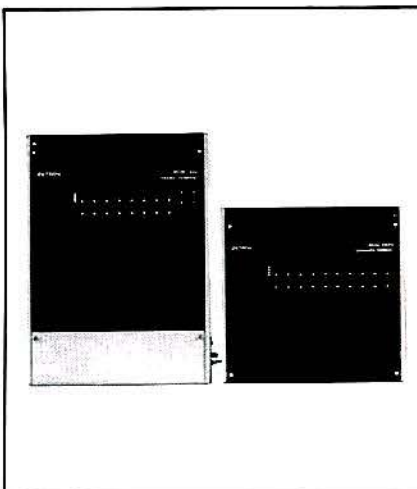
### Communication console



Positron Industries' 304S/TRCC telephone and radio communication console integrates paging and call identification with telephone and radio equipment control. It handles as many as 240 lines and comes configured for flush-mounting or desktop placement.

Circle (341) on Fast Fact Card

### Expansion chassis increases paging terminal's capacity



Zetron makes an expansion chassis for its model 2200 paging terminal. The chassis, model 2200EX, provides 10 extra slots for "dual telco cards" and expands the terminal's capacity to 38 incoming telephone lines.

Circle (359) on Fast Fact Card

## \*Mod-u-lá-rity

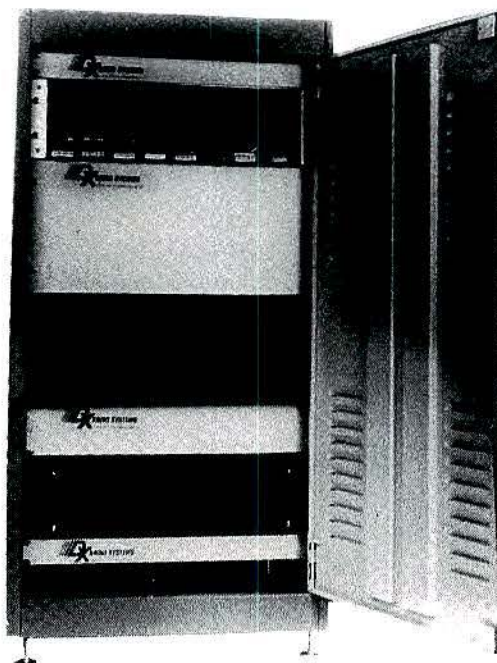
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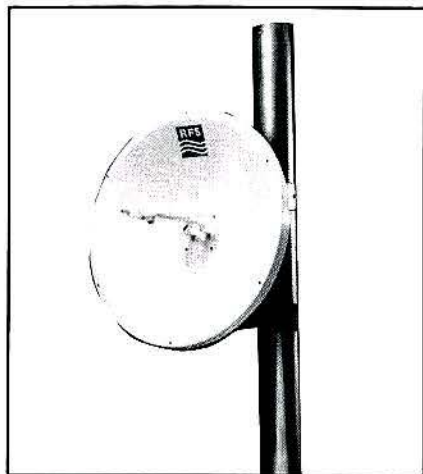


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Circle (40) on Fast Fact Card

### 23 GHz antennas have spun aluminum reflectors



Center fed waveguide feeds and galvanized steel tower mounts are standard on 23GHz antennas made by **Cablewave Systems**. The series includes 2-, 4- and 6-foot antennas for microwave communications links. The antennas are available in high performance shrouded and standard parabolic configurations.

Circle (442) on Fast Fact Card



John Scarpa, Amcell

**“Building a regional cellular network such as Amcell’s requires keeping up with the latest technical and regulatory developments in the industry.**

**I’ve found that Telocator conventions provided my company with crucial information in these areas.”**



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• Outstanding social events that bring together leaders from throughout the mobile industry for invaluable contacts. This year’s convention includes a gala “Welcome to Washington” celebration in beautiful, historic Union Station.

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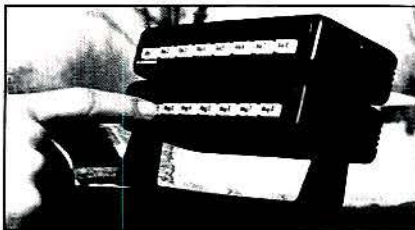
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## New products

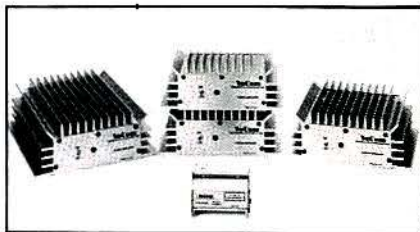
### Message control system frees up voice channel

Motorola's Stat-Alert status and message system features eight status and eight message buttons that enable the operator to send automatic IDs, routine status updates and emergency notifications without tying up the voice channel. The mobile unit is field programmable.



Circle (443) on Fast Fact Card

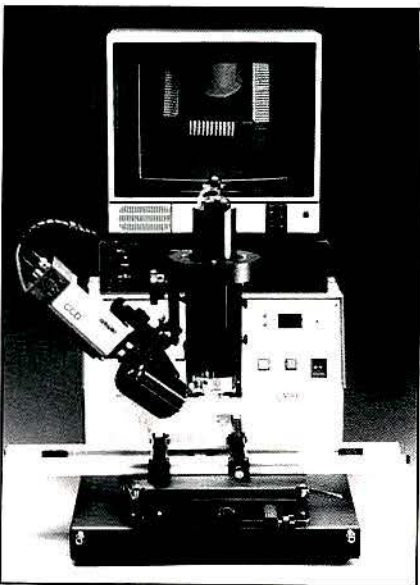
### Amplifier line spans VHF lowband to 800MHz



Expansion to VoCom's line of RF power amplifiers includes units that cover all frequency ranges from VHF lowband through 800MHz. Low-input drive units are available in the line.

Circle (157) on Fast Fact Card

### SMD workstation maintains thermal process control



The Craft-15 surface-mount device (SMD) component installation and repair system provides thermal process control and accurate SMD alignment and placement. The Pace single-head station maintains air and gas temperatures between 500°F and 800°F. A work-positioning table permits accurate placement of components to their footprints, and an optional stereo microscope or high-resolution color CCTV system can be mounted on the placement and reflow head. Standard and custom nozzles are available, and the unit is complete with its own air and vacuum generators.

Circle (464) on Fast Fact Card

# THE PERFECT MATCH.

**YOUR RADIO AND OUR NOISE ATTENUATING HEADSET.**

High noise can make two-way radio communication difficult, if not impossible. Combine your two-way radio with one of our Noise Attenuating Headsets to solve this problem.

David Clark Company Headsets combine maximum hearing protection, with comfort and perfect reception. Superior noise-canceling microphones deliver clear transmissions at normal voice levels.

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Circle (85) on Fast Fact Card



Save



When a life lies in the balance, you need the best. You need the Call Check digital message repeater from Dictaphone.

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uninterruptable power supply to protect against losses of power for

up to 10 minutes. So you can breathe a bit easier in case of a power failure.

As you'd expect, Call Check instantly replays telephone messages. But it also does so without interrupting recording of incoming calls. Meaning messages, and hopefully lives, will never be lost.

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What's more, Call Check is the only message repeater that visually displays the messages you receive, as well as the times you receive them.

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When you can't afford to take chances, the choice is very simple: the Call Check digital message repeater from Dictaphone. To find out more, mail in the coupon, fax to 1-203-381-7100 or call 1-800-433-0880. It could help you save much more than messages.

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Circle (86) on Fast Fact Card



## New products

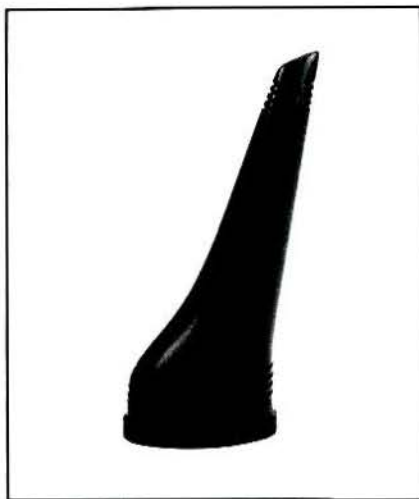
### Test lead adapter kit is used with multimeter



Four choice of test contact leads are offered with the **Pomona Electronics'** multimeter test lead adapter kit. Test lead wire contains heat- and chemical-resistant silicone insulation.

Circle (441) on Fast Fact Card

### 'Shark fin' cellular antenna



The "shark fin" shape of **Ora Electronics'** CMS555 cellular antenna mounts to a vehicle roof or trunk. Its low profile and aerodynamic design are intended for aesthetic appeal and to reduce wind noise.

Circle (319) on Fast Fact Card

### Portable has ramped controls



The PCS portable is designed to fit into the palm of the hand and to provide one-hand operation. Ramped controls and a backlit LCD show volume level and operating channel. **GE Mobile Communications** makes the portable available in two-channel or eight-channel versions with a carrier control timer, CTCSS, DCS and a squelch tail eliminator.

Circle (321) on Fast Fact Card

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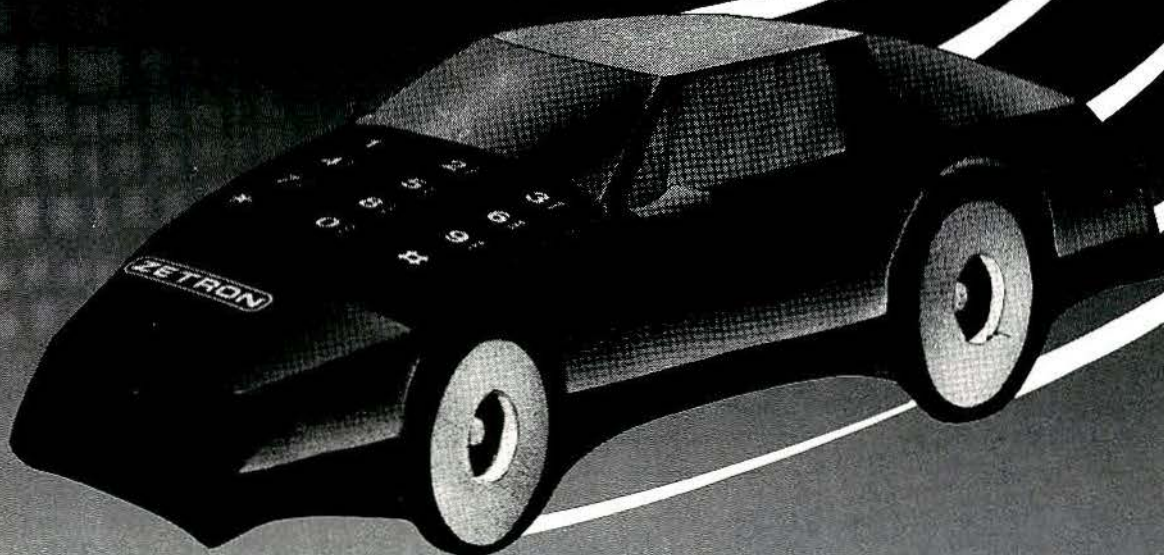
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Circle (88) on Fast Fact Card



# ZETRON MICROPHONES EXCEED THE INTERCONNECT SPEED LIMIT



## The ZM Series of Smart DTMF Microphones, Guaranteed to Accelerate Mobile Telephone Calls

### MAKE EVERY KEYSTROKE COUNT

The Zetron Model ZM-1 and ZM-A (Autodial) are extraordinary DTMF microphones. An innovative new key buffering technique actually times each DTMF digit over the radio channel.

Regardless of how quickly or slowly you press the keys, ZM microphones feed your phone patch the DTMF at a regular rate. Clipped first digits, double digit entries, and lost digits are problems of the past.

### REDUCE RADIO ANXIETY

ZM microphones are nearly as easy to use as a telephone. Automatic P.T.T. when entering digits, programmable long \* and # codes, and preset DTMF tone lengths and pauses put through calls on the first try. Since you can program Zetron mics to emulate other popular brands, operator training is reduced. Gone are the days where "the third try is a charm".

**ZETRON**

*Technology on the Move*

### REGAIN VALUABLE AIRTIME

Put every minute of airtime to full use. Precisely timed dialing reduces wrong numbers. Audio mute while dialing keeps DTMF tones clean. Stuck mic timeout frees the channel when users don't.

The ZM-A model can even store and forward, speed dial, and recall/redial the last number and automatically connect/disconnect with ANI from the mic hanger. Experts will agree that Zetron has put all the best features into the ZM-A.

### SATISFY TOUGH DEMANDS

A rugged case, heavy-duty P.T.T. switch, generous keypad size, and external level adjust show that ZM mics are built to last.

***Call us today and put your  
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Circle (89) on Fast Fact Card





## New products

### Alarm monitor stores voice



Model 1512 SentiDial alarm monitor stores voice and connects with a standard telephone line. When the monitor detects an external contact closure, it dials as many as 10 telephone numbers to play a recorded voice when the calls are answered. The Zetron monitor sends DTMF messages, too.

Circle (352) on Fast Fact Card

### Vehicle navigation system works with GPS satellites

Using signals from two sets of satellites, the **Magnavox** vehicle integrated navigation system (VINS) determines a vehicle's geographic location; direction and speed of travel; and direction and distance to multiple destinations. Navigation input is provided by the satellite Global Positioning System (GPS) and in-vehicle sensors. In-vehicle components include a MX 6102 terrain navigator, a MX 6400 GPS receiver, a fluxgate compass, speed sensor and barometric altimeter. The system can be configured for remote control and in-vehicle operation.

Circle (460) on Fast Fact Card

### Coax preparation tools

**Andrew's** cable preparation tools make fast and precise cuts in as little as 15 seconds. Each cut is made at the crests of corrugations in 1/4" and 1/2" Andrew hardline coaxial cable.

Circle (317) on Fast Fact Card

### Data networking system



An error-free radio data networking system designed by **Modems Plus** provides real-time remote access to a main-frame database at a host computer site at speeds of either 4,800bps or 9,600bps. The Comm Rad system adapts to existing voice radio networks and uses existing laptops, personal computers and other DOS-based terminals.

Circle (336) on Fast Fact Card

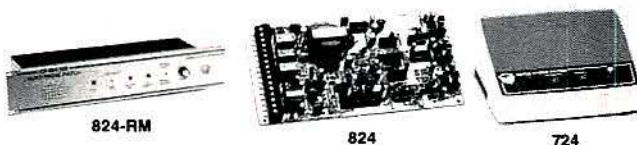
## PROBLEM SOLVERS...

- DC Remotes
- Tone Remotes
- Local Extensions

Besides manufacturing a complete line of remote control units, Communications Products also manufactures other products for system flexibility.

The Model 724 is a simplex telephone patch for use on a two way radio. Voice path between mobile and telephone is controlled by a vox circuit; sensitivity and dropout time is adjustable.

The Model 824 is a fully automatic interconnect for repeater use. The unit is accessed from the mobile by DTMF "★" and "#", audio direction is controlled by the C.O.S. line on the repeater.



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824

724

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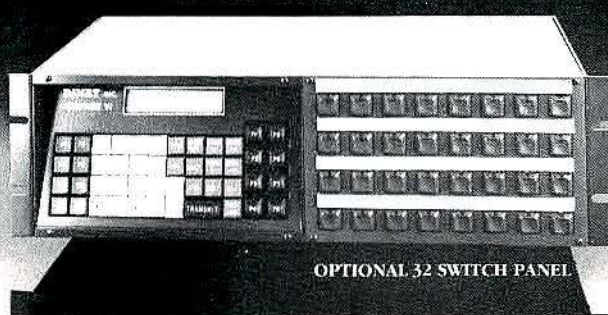
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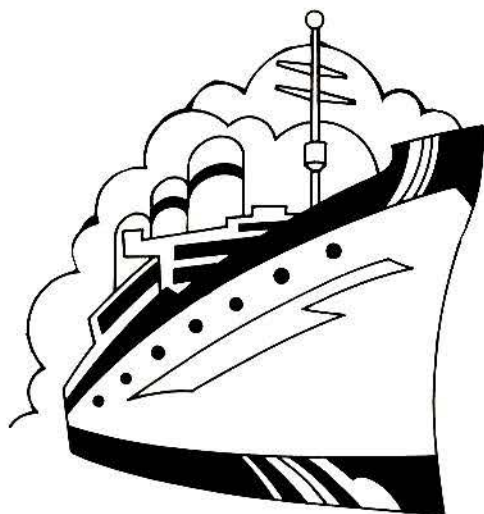
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# **G C** GENERAL COMMUNICATIONS, INC.

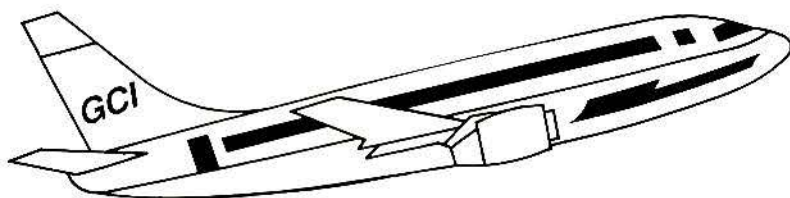


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*Don't Let Our Next Trip Fly By...*



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## New products

### 'Trim' mobile fits smaller dashboards

Uniden's microprocessor-controlled SMH/SMU 36-channel mobile radio comes in a trim package designed to fit smaller dashboards. Programming op-

tions include multiple CTCSS and DCS, external programming, channel scanning, priority and simplex (talkaround).

Circle (202) on Fast Fact Card

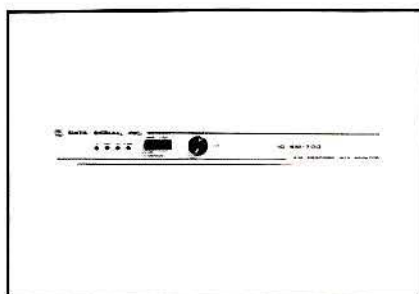
### UHF duplexers use stripline combining



Circle (209) on Fast Fact Card

ACD-2600 bandpass-bandreject UHF duplexers use stripline combining for low loss and high isolation with four cavities. Stripline combining design eliminates cavity intercabling, cable loss and noisy connectors. The **Antenna Specialists** duplexers have finger tuning capability, which permits exact frequency settings without the use of sockets or wrenches.

### CW Ider/site-fault monitor



Data Signal's ID/SM-700 CW identifier and site fault monitor functions are programmed by DIP switch or keypad. The Ider can be operated in COR or continuous modes. An inhibit input is available.

Circle (346) on Fast Fact Card

## CHECK THIS OUT!

### A MODEM DESIGNED FOR YOUR RADIO SYSTEM.

The B1449 is the Radio Modem you need to effectively send and receive data over your radio and/or wire line system. The B1449 operates half or full duplex at speeds of 300 baud (Bell 103), 1200 baud (Bell 202), 2400 bps (V.27) or 4800 bps (V.27). This modem is loaded with features to overcome problems unique to data transmission via two-way radio. It operates on any DC voltage from +12 to +30V in a temperature range of -30 to +50°C. You can use it at any remote locations powered by battery, solar cells, wind or thermoelectric generator. You can even use it in your vehicle for data transmission.

#### APPLICATIONS

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## TWO TONE GENERATOR

### MODEL 2TSG-1

NOW WITH COMPLETE  
3 YEAR WARRANTY

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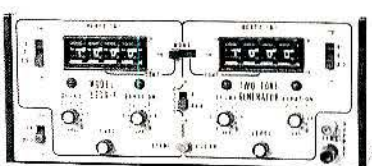
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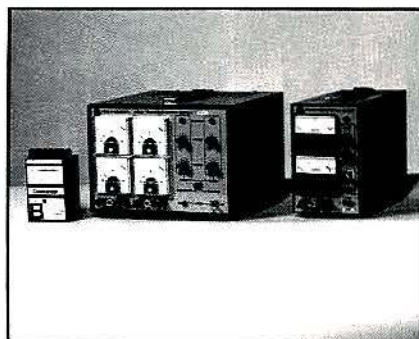
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Circle (94) on Fast Fact Card

### Dc power supplies



Brunelle Commander series regulated dc power supplies feature short-circuit protection, automatic constant current and constant voltage output with low ripple. Sixteen models are available.

Circle (316) on Fast Fact Card

### Portable cellular antennas

Ora Electronics has added two replacement antennas to its line of cellular products:

□ Model CMS330, a halfwave molded portable antenna with 2.5dB gain compared to a quarterwave monopole on a ground plane. The antenna comes with an SMA male connector.

□ Model CMS331 is a quarterwave version of the CMS330 and has an injection-molded outer covering.

The antennas fit Technophone, STS and other hand-held cellular telephones.

Circle (318) on Fast Fact Card



# Commonwealth Speaks Your Language

If you don't get the message, you won't get the business—so commonwealth has eliminated language barriers.

Commonwealth Communications is introducing its multilingual voice prompts for your MARK digital paging terminals. Now you can select caller prompts in sets of any four different languages.

Of course, Commonwealth quality is built into this new feature. Our Adaptive Delta Pulse Code Modulation method of recording and playing back voice prompts results in realistic, pleasant and highly audible speech.

If you would like to hear one of our multilingual voice prompts, dial (804) 798-9151. Dial format numbers 1-5 for English prompts, and enter numbers 6-0 for the same prompts in Spanish.

Remember, Commonwealth has been in business longer than any computerized paging terminal manufacturer in the nation. And we're proud to say we're still operated by our founders.

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**DOC Approved**



*Ted Faust  
Vice President of Sales  
and Marketing*

*Thank you*

*Merci*

**DANKE**

*Gracias*



## New products

### Power meter calibrator works within $\pm 3\%$



Model 4029 power sensor calibrator by **Bird Electronic**, when used in conjunction with a computer, calibrates the

company's 4420 RF power meters within  $\pm 3\%$  of the RF standard. The calibrator automatically calculates and stores a correction factor for a specific frequency in the power sensor's memory. The unit's functions include adding or deleting individual calibration points; clearing all points; and listing calibration points for review. The unit comes with connectors for standard 25-pin serial cable and power sensor cable. The operating voltage is 115Vac/230Vac, 50Hz/60Hz.

Circle (204) on Fast Fact Card

### Lowband mobile features 50W to 110W RF output

The SC350X **Shinwa** mobile operates in the 30MHz to 50MHz band. The lowband unit has 50W to 110W output,

16 channels, priority scan and noise blanker.

Circle (457) on Fast Fact Card

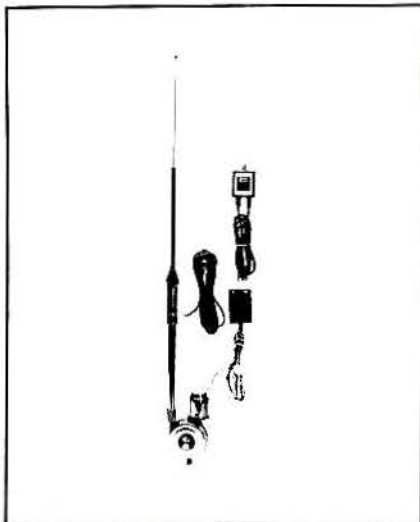
### Tester for two-way, cellular

Model 2500 test instrument from **CT Systems** combines a cellular tester, cell-site simulator and service monitor. It works in a "go-no-go" automatic mode for quick cellular mobile telephone testing, a manual mode for troubleshooting and as a stand-alone two-way radio service monitor.



Circle (354) on Fast Fact Card

### Cellular, AM, FM antenna features motorized mast



The CMX1000 combination cellular, AM and FM antenna installs on a vehicle's fender and incorporates a motorized mast. Made by **Ora Electronics**, the antenna offers an SWR of 1.5:1 and 3dB gain.

Circle (438) on Fast Fact Card

### Fixed station cellular unit serves as security system



The Cell-U-Phone fixed station cellular phone unit from **Antenna Specialists** provides a cable-free link with a security system central monitor. The wall-mounted unit installs in minutes and contains a standard telephone transmitter and receiver, logic under microprocessor control, electronic memory and audio circuitry for automatic response to the alarm system.

Circle (449) on Fast Fact Card

## "IT TALKS"

### ON YOUR RADIO, P.A. SYSTEM AND TELEPHONE.

With high quality voice synthesis, the B1260 ALARM REPORTING UNIT will satisfy your needs. You will save money with a quicker response and less down time. It also adds a measure of safety because it reports problems immediately. The B1260 will automatically talk on any two-way radio, telephone, P.A. system or all three. Connect it to your radio system and announce problems as they happen. Hook it up to your plant P.A. system and announce dangerous conditions. It will telephone your "on-call" personnel and/or answering service and tell them where and what the problem is. Installation is easy and the B1260 is cost effective.

#### TYPICAL APPLICATIONS

- Unattended site status.
- Computer room alarms.
- Power failure reporting.
- Fire and security alarms.
- High and low water level reporting.
- Poisonous and dangerous gas alarm.
- High and low temperature reporting.
- Pump, valve and compressor monitor.

For more information, contact:



**Quality Telecom  
Supply Ltd.**

2874 Catalina Blvd. N.E.,  
Calgary, Alberta, Canada,  
T1Y 6P2

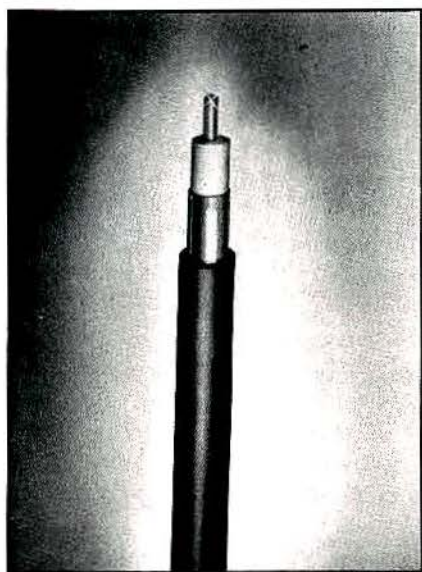
Ph. (403) 293-1965

Distributor and Dealer inquiries welcome!

Circle (97) on Fast Fact Card



## Slotted coaxial cable



Radiaflex coaxial cables from Cablewave Systems are designed for paging, two-way radio and monitoring purposes in tunnels, mines, ships and buildings where normal radio transmission is difficult. The cables act as though they were continuous broadband antennas.

Model AHF/AHX has a continuous longitudinal slot.

Model ALF has coupling slots spaced at random intervals.

The cable is available in 3/8", 7/8" and 1 1/8" diameters with 50Ω and 75Ω impedance.

Circle (347) on Fast Fact Card

## 800MHz trunked radios

Uniden offers two 800MHz trunked portables, including:

☐ Model SPS 310 with 1.5W RF output and talk-around capability.

☐ Model SPS 320TS with a DTMF keyboard and scanning capability for eight systems and eight groups per system.

Two 800MHz trunked mobiles include:

☐ Model SMS 815T with four systems, four groups per system and 15W RF output.

☐ Model SMS 385TS with 10 systems, 10 groups per system and 35W RF output. It has scanning; mixed conventional and trunked operation; and CTCSS and DCS capability.

Circle (361) on Fast Fact Card

## Telephone interconnect

Model SDI-50 telephone interconnect works on simplex, half-duplex and full-duplex mobile radio systems. The CES unit is automatic and programmable.

When used as a simplex interconnect, the unit's microprocessor-controlled VOX circuitry varies the sampling rate for smoother-sounding audio.



Circle (371) on Fast Fact Card

**NEW**

# 90% Capacity Guaranteed 15 Months

**Introducing the best warranty in the business.**  
**The Lexstar warranty from Alexander.**  
Only Alexander sorts and combines the highest capacity cells available to offer the highest capacity batteries on the market in their Lexstar battery line. Then Alexander goes the extra step of guaranteeing all Lexstar batteries to hold at least 90%—not just 80%—of stated capacity for 15—not just 12—months. This is the best warranty available today.

**Can't short.**  
All Lexstar batteries feature a unique internal protection system which prevents damage from short circuits. Yet, there are no fuses. Think of our system as an automatically resettable circuit breaker.

**Free catalog just for asking.**  
For your copy of our catalog listing our more popular radio, pager and other batteries, call 1-800-247-1821 or ask your local authorized representative.



## Alexander Batteries

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Tel: 1-800-247-1821 or 515-423-8955  
UK  
P.O. Box 10, Peterlee, Co. Durham,  
SRS 211R Tel: 44 (0)91-587-2787

Circle (108) on Fast Fact Card



## New products

### Replacement batteries fit Motorola Radius series

Alexander Batteries makes replacement batteries for Motorola Radius portables:

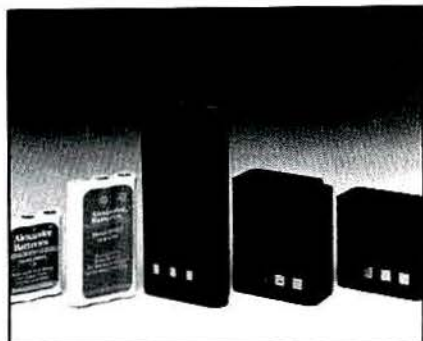
□ Model H5451 10V 1Ah replaces NTN5531A (60-60930L43) for the P100.

□ H9044 7.5V 500mAh standard-charge replaces model HNN9044A

(60-60937H01) for the Radius P10/P50 (low power).

□ H9027 10.8V 500mAh replaces model HNN9027A (60-60937H02) for the Radius P50 (high power).

□ H5531 10V 600mAh rapid-charge replaces model NTN5531A (60-60930L43) for the Radius P200.



□ H5521 10V 1,000mAh rapid charge replaces model NTN5521A (60-60930L41) for the Radius P200.

□ H5545 10V 1,000mAh (intrinsically safe) rapid-charge replaces NTN5545A (60-60930L45) for the Radius P200.

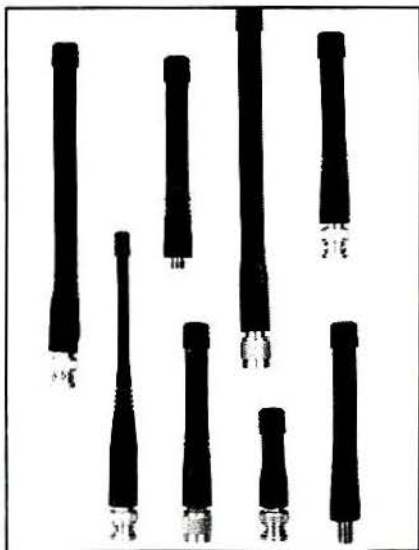
Circle (262) on Fast Fact Card

### Repeater panel software uses digital signal processing

The ToneTrak community repeater tone panel software incorporates digital signal processing and tracks CTCSS tones to 2dB nominal. With the software from CSI, decode performance is improved with a recognition time of 120ms. Tone sensitivity is improved with the software.

Circle (445) on Fast Fact Card

### Portable radio antennas



Ora Electronics' Spirit UHF and VHF portable antennas fit most commercial transceivers.

Circle (367) on Fast Fact Card

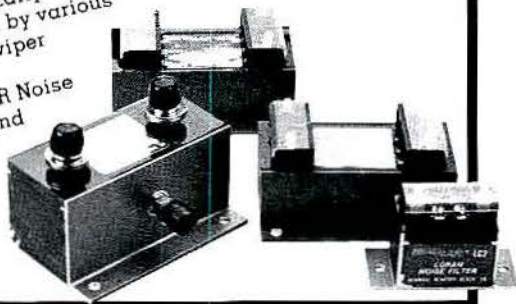
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NEWMAR Noise Filters purify the performance of radios, stereos, and communication equipment in vehicles, heavy equipment, trucks and buses.

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Like our quality and service. For over half a century, Savoy Electronics, Inc. has been dedicated to providing superior service. In addition, our quartz crystals and oscillators remain the highest quality available, and that will never change.

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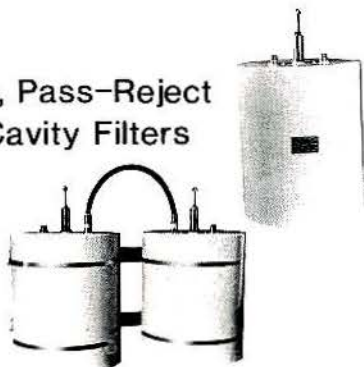
Circle (110) on Fast Fact Card



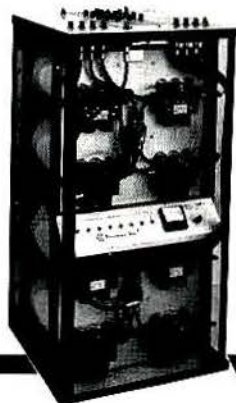
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and Filters • Duplexers • Systems Engineering***

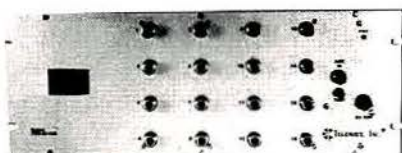
Bandpass, Pass-Reject  
& Notch Cavity Filters



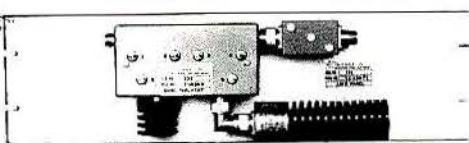
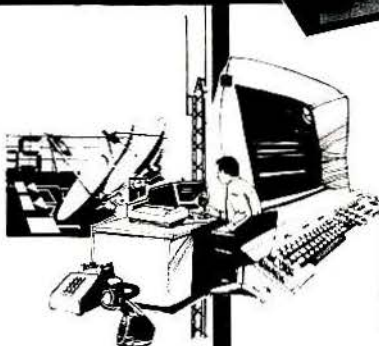
Transmitter Combining



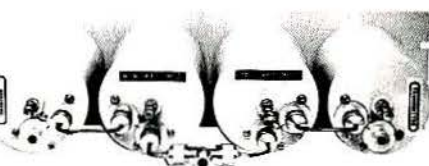
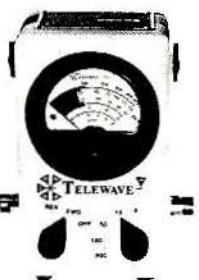
IM Suppression Panels



Receiver Multicoupling

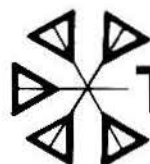


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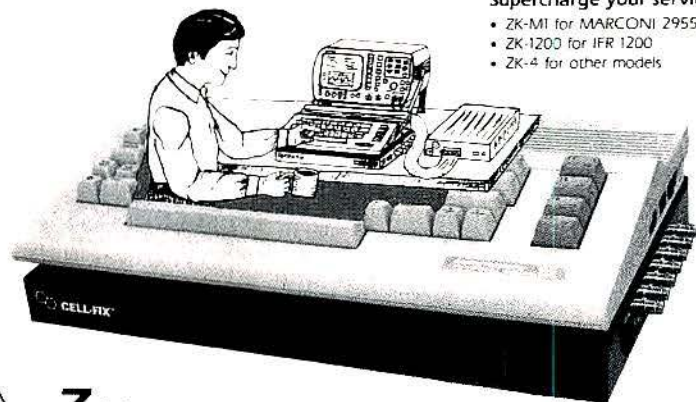


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20kHz to 1.5GHz  
300 Microvolts to 100V  
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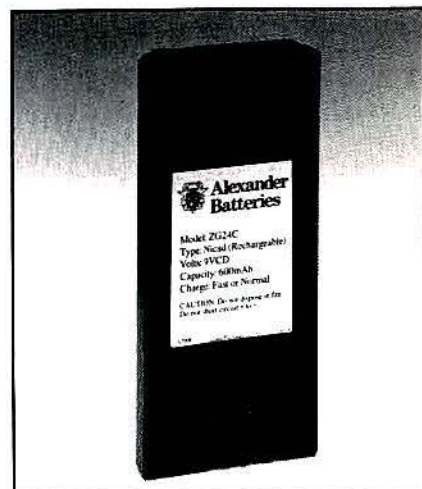
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FAX: 407/777-1447  
TELEX: 362837 (Helper UD)

**HELPER INSTRUMENTS COMPANY**  
P.O. Box 3628  
Indianapolis, Florida 32903 USA

Circle (114) on Fast Fact Card

## New products

### Replacement batteries fit Shinwa, Ericsson radios



Replacement batteries are available for Shinwa UR50P, UR40P and SH503KG radios. The same battery in brown is a replacement for Ericsson P200 radios. Made by **Alexander Manufacturing**, the replacement battery, ZG24C, is 9.6V with 600mAh.

Circle (452) on Fast Fact Card

### Power supply boasts magnetic regulation



High input impedance, peak load endurance, overvoltage and overload protection make the **Ritz Electronics** PS5013MR magnetic regulated power supply suitable for radio communications base stations. Its ferro-resonant design blocks current surges caused by lightning. The 13.8Vdc, 50A supply endures a peak of at least 220% of its rated current. Models rated at 6A, 8A, 10A and 25A are available.

Circle (203) on Fast Fact Card



# RITRON<sup>®</sup>

## RF Telemetry/Voice Modules Transmitters-Receivers Transceivers

Ritron RF Telemetry/Voice Modules provide low cost, wireless communication channels via narrow-band FM radio.

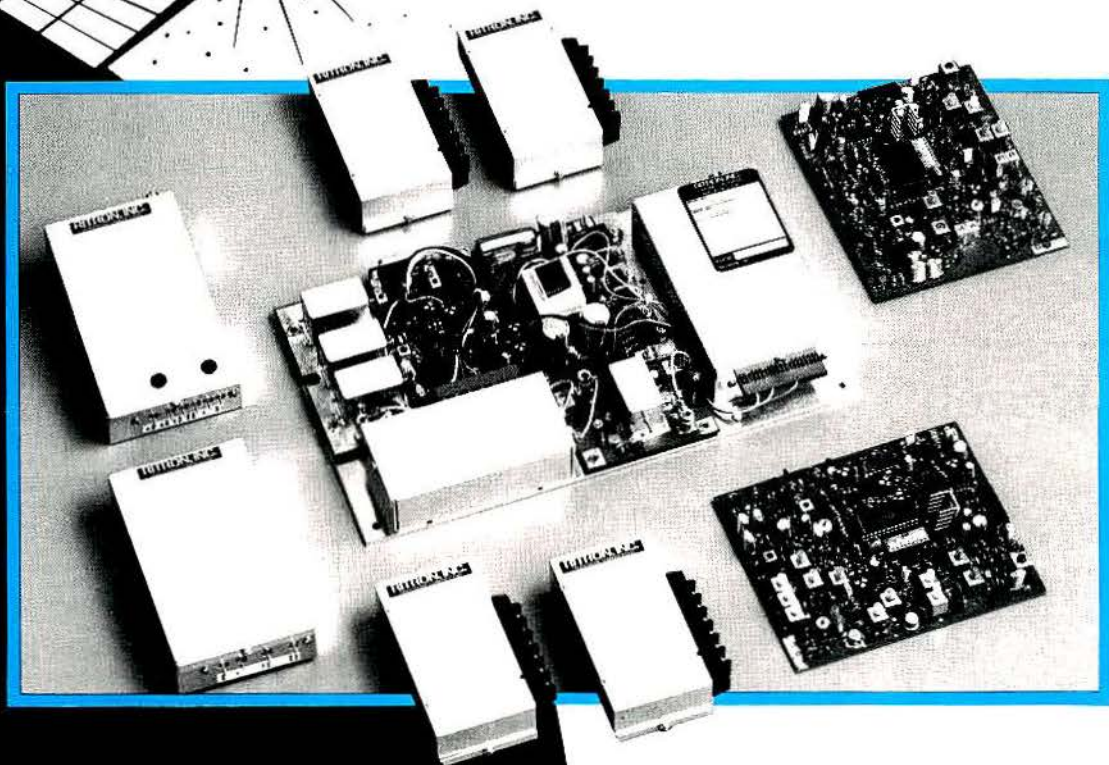
In many systems, developing the communications link can become extremely expensive. Now, you can create affordable communications networks that cost less than wireline, optical, cable or microwave circuits.

The complete line of Ritron transmitters, receivers and transceivers can provide narrow-band voice-grade (3 to 3,000 Hz) links over Point to Point or Multi-Point networks. Simplex, Half-Duplex and Full Duplex models are available in several frequency bands.

Ritron RF modules are F.C.C. approved, and where applicable, can be installed in O.E.M. equipment without additional F.C.C. Type Acceptance or Notification.

If you need DATA ACQUISITION, REMOTE CONTROL, MONITORING, ALARM REPORTING or METERING, Ritron RF modules can easily be connected to intercoms, modems, balanced lines or telco circuits.

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THE U.S.A.



## New products

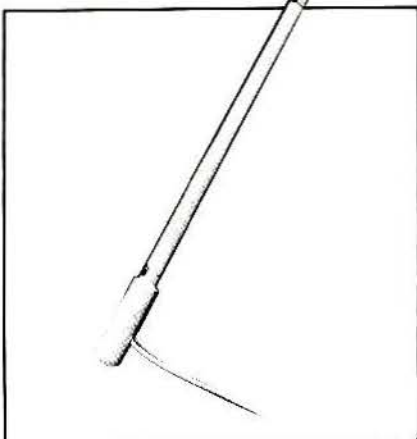
### UHF synthesized mobiles

Syn-Tech II programmable, software-driven UHF mobiles made by **Midland LMR**, boast adjustable 15W to 30W RF output. A dual high-low option provides 15W-to-30W and 1W-to-10W power ranges that may be selected by a panel switch or programmed by channel. The mobiles cover 450MHz to 470MHz with as many as 320 channels in as many as 16 groups.



Circle (339) on Fast Fact Card

### Marine cellular antenna features 3dB gain



The ASMD942 white fiberglass marine cellular antenna is 2 feet long and offers 3dB gain with as much as 40W continuous power. Two models are available from **Antenna Specialists** with either a mini UHF connector or a TNC male connector. The antenna fits standard marine mount hardware.

Circle (385) on Fast Fact Card

## ALARM REPORTING!

### IS IT IMPORTANT TO YOU?

The B1125 ALARM REPORTING UNIT will satisfy your needs.

The B1125 will talk on any two-way radio and/or public address system with high quality voice synthesis. You can now reliably report any type of alarm condition automatically. It will save you money because response time will be shorter and down time will be less. The B1125 also adds a measure of safety by reporting problems right away. Installation is simple and the B1125 doesn't cost much.

#### TYPICAL APPLICATIONS:

- Fire Alarm.
- Security Alarm.
- High H2S Gas Alarm.
- Power Failure Reporting.
- Vehicle Emergency Transmission.
- High or Low Water Level Reporting.
- High or Low Temperature Reporting.
- Pump, Valve or Compressor Monitor.



**Quality Telecom Supply Ltd.**

2874 Catalina Blvd. N.E., Calgary, Alberta, Canada, T1Y 6P2  
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Distributor and Dealer inquiries welcome!

Circle (99) on Fast Fact Card

### Analyzer takes 64 batteries



The **Cadex C6000** analyzes 64 batteries in 24 hours. Detachable battery modules fit individual battery types to allow 16 types of batteries to be serviced simultaneously.

Circle (355) on Fast Fact Card

## The Reach Tone & Voice Pager

You can not buy a better pager at any price

#### FEATURES:

- ★ Crisp, Clear Audio
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- ★ 24 Hour A Day Operation
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### No battery charging

(Several months continuous service on a single throwaway battery)



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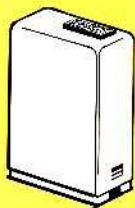
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TWX 910-960-4741 (308) 324-6661  
FAX 308-324-4985 (800) 445-0007

Circle (100) on Fast Fact Card

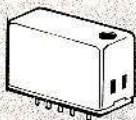


Tactel  
MI594008



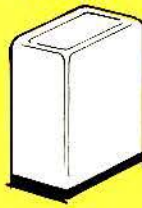
Series for  
Veetac models

Motorola\*  
KXN1034  
KXN1035



and others for  
MT-500 models

Tactel  
MI559230  
MI559241



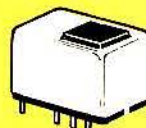
Series for 500/700/1000  
and ML-1000 models

Motorola  
KXN1086  
KXN1088



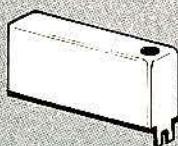
Series for  
Mitrek\* models

General  
Electric  
4EG25A10



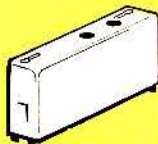
and others for  
various models

Tactel  
MI559766



Series for  
Tac-100  
model

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Electric  
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(2C) Series

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ICM manufactures the TCXO Oscillators used in Tactel products, including the Tactel ML-1000, Tac-100 and other Veetac equipment. We can supply reconditioned elements for all other brands of equipment. Our half million dollar inventory changes daily. Call for immediate information on availability. Write or call for Channel Element Brochure.

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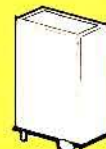
Crystals for all elements are installed and thoroughly tested by ICM. Computerized equipment is used to compensate the element to match the crystal temperature curve. Before shipping, all units will meet or exceed stability requirements in the equipment for which they were designed.

Motorola\*  
KNX1024A



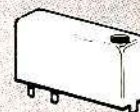
and others for  
MICOR\*  
models

Motorola\*  
KXN1040A  
KXN1041A



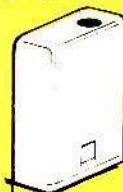
and others for  
MX series  
models

General  
Electric  
4EG28A13



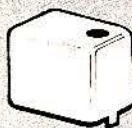
and others for  
Sicom models

General Electric  
19A129393GXX  
19A137763GXX



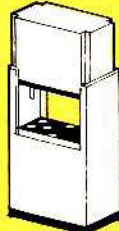
Series

Motorola\*  
K1040/K1048



and others

Motorola\*  
TLN8967A TLN8968A



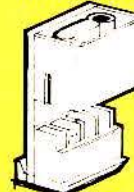
and others

General  
Electric  
19A130605GXX



Series

General  
Electric  
19A226962GXX

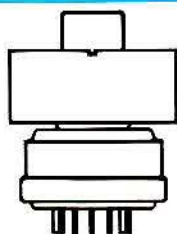


Series

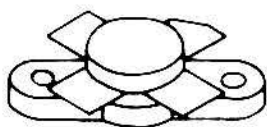
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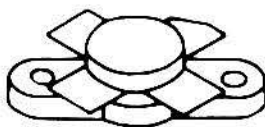
# Maximize Your GAIN...



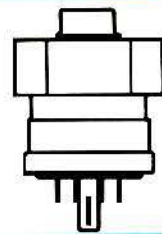
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97-10887A01



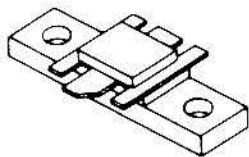
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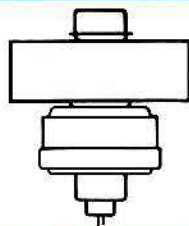
MRF455, MRF224  
SD1018-6



8560A/AS  
65-83382D02



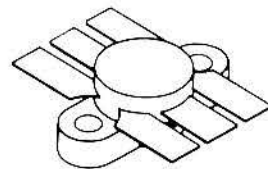
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SD1421



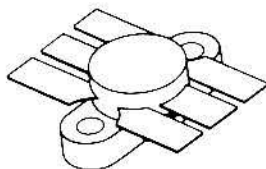
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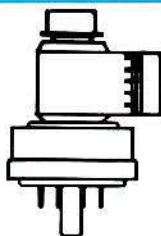
8643  
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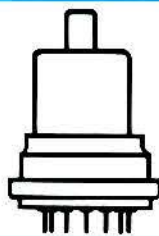
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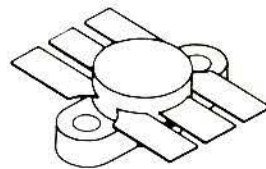
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19A134340P2



4CS250R



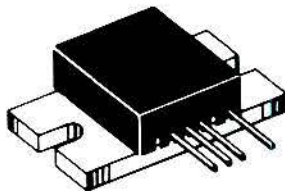
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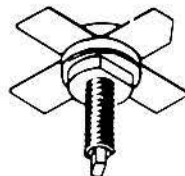
MRF646  
MRF247



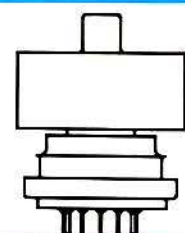
5894B/8737



74N03  
51-82274N03



48-869583  
EFJ4051



8122

## With RF GAIN

In 1979 RF Gain was created in the midst of a communications market needing an alternative source to the original equipment manufacturer.

Today, RF Gain, as a division of Richardson Electronics, Ltd., is serving all aspects of the communications industry — from radio repair shops to major OEMs worldwide. We have built a successful worldwide operation by offering a vast supply of electron tubes.

closed circuit television equipment and RF transistors. Major manufacturers we represent include Acrian, Amperex, EIMAC, Motorola, National, Philips and SGS-Thomson.

A 90% same-day shipping record assures the service you need.

Contact Richardson/RF Gain to receive our latest communications catalog and the industry's most extensive semiconductor cross-reference guide. For PC users, we also

offer our cross-referencing and price list on disk. That way, all the semiconductor cross-reference information you require.



**Richardson Electronics, Ltd.**

**Corporate Headquarters**

**RF Gain Division**  
**All USA Sales Offices**  
**U.S. Export Inquiries**  
**Europe/England**  
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**All other international inquiries call Corporate Headquarters.**

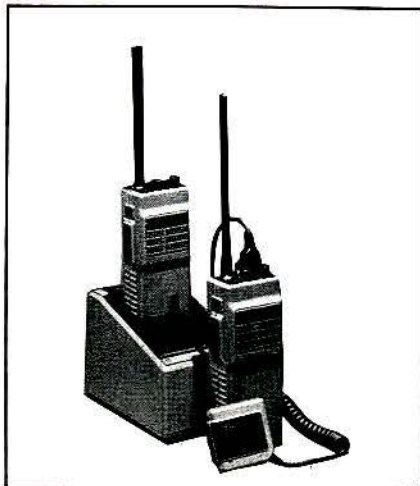
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## New products

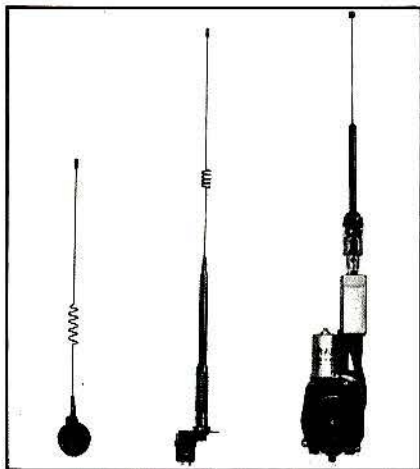
**2W UHF portable  
comes with wall charger**



The **Tekk TS-470** 2W two-channel portable handles every signaling format and data communications. It is powered by a BP-4 battery and comes with a BNC antenna and wall charger.

Circle (155) on Fast Fact Card

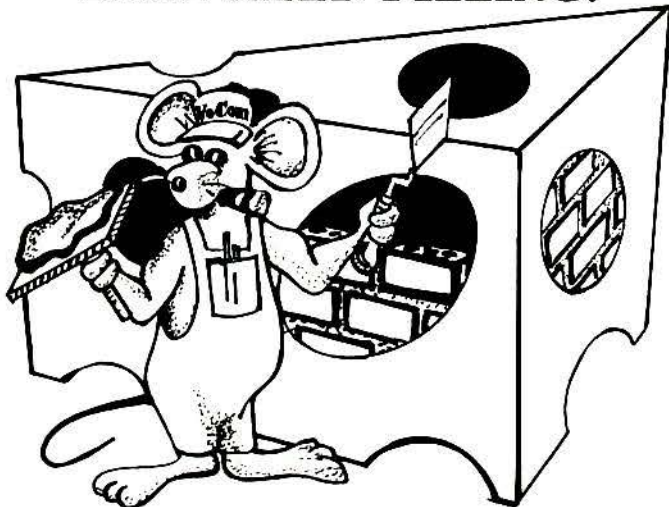
**Cellular antennas mount  
on window or trunk**



Two cellular antennas, a glass-mount and an elevated feed, are available from **Harada Industry of America**. Model CAWB-30 glass-mount antenna is a 3dB gain unit with 5W maximum. Model CAEB-30 elevated feed antenna can be converted into two styles: a trunk-mount unit or a removable trunk-lip mount unit. It is a 3dB gain antenna with 5W maximum.

Circle (450) on Fast Fact Card

## COVERAGE GOT SOME HOLES THAT NEED FILLING?



**THEN STOP MOUSE-ING AROUND!  
POWER UP WITH TOUGH, RELIABLE R.F. AMPLIFIERS FROM VoCom.**

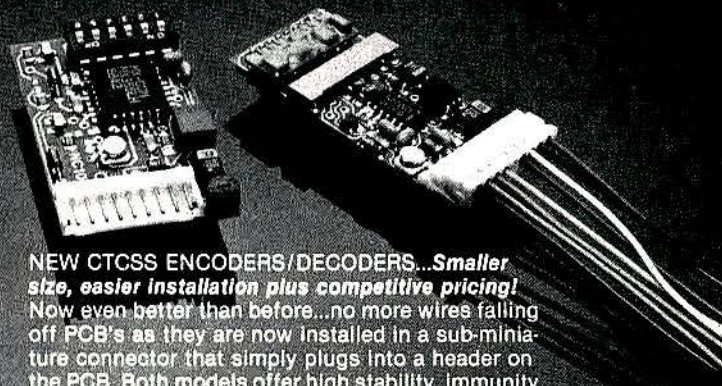
Don't get trapped by cheesy amplifiers.  
Get your power from the one company that does nothing *but* amplifiers.  
We know our stuff, dudes!

PAGING, REPEATERS, MOBILES — GIVE US A CALL  
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Circle (115) on Fast Fact Card

## WELL CONNECTED.



**NEW CTCS ENCODERS/DECODERS...Smaller size, easier installation plus competitive pricing!**  
Now even better than before...no more wires falling off PCB's as they are now installed in a sub-miniature connector that simply plugs into a header on the PCB. Both models offer high stability, immunity to RF, high pass filter and meet all specs for EIA RS-200-A.

**Model NC102 — Size: 0.8"W x 1.60"L x 0.20"H**

**Model NC108 — Size: 1.0"W x 1.7"L x 0.22"H**

Call or write today for pricing and full specifications.



**TOLL FREE SALES 800-874-8663 / In California Call (916) 477-8400 / FAX (916) 477-8403**  
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Circle (116) on Fast Fact Card



## New products

### Trunk-mount mobile offers 99 channels



Circle (448) on Fast Fact Card

The Lancer-M wideband trunk-mount mobile includes 99 channels, dual-priority scan and EEPROM programming. The Aerotron unit has adjustable RF output from 40W to 100W. Die-cast shields are used in the transceiver, and its construction meets military specs.

### Radio interface module features 'priority selection'



The U3812 dual radio interface module available from David Clark connects two mobiles within the same vehicle. The module allows the user to assign priority to reception from one of the mobiles; to transmit on either the touch of a button; and to override priority selection to receive on the secondary mobile without interruption. The module works with the company's "series 3800" group of vehicle intercom system products.

Circle (446) on Fast Fact Card

### Replacement 2-way batteries

Replacement NiCd batteries from Multiplier fit Motorola portables:

☐ M5407 10V 600mAh rapid-charge replaces model NTN5407A for the Motorola HT-50.

☐ M5406 10V 600mAh standard-charge replaces model NTN5406A for the Motorola HT-50.

☐ M9044 7.2V 500mAh rapid-charge replaces model HNN9044A for the Radius P10/P50.

☐ M9027 10.8V 500mAh rapid-charge replaces model HNN9027A for the Radius P10/P50.

☐ M4818 10V 600mAh rapid-charge replaces model NTN4818B for the Radius P100.

☐ M5451 10V 1,000mAh rapid-charge replaces model NTN5451A for the Radius P100 and the low-capacity (600mAh) NTN4817B (60-60930M02) and NTN4818 (60-60930M01).

Circle (338) on Fast Fact Card

## The BEST NAM Programmer Money Can Buy.

**\$1295.**

### The NAMPRO-300D™

- 40 Character LCD guides user thru Menus of Cellular Telephone Models and their Options.
- Stores and Recalls 32 NAMs.
- FREE Printer Port.
- NEW Philips FM9000 Adapter.
- Portable NOW Available.

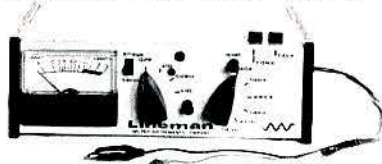
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## IF YOU WORK ON SYSTEMS WITH PHONE LINES YOU NEED A LINEMAN™



MODEL LM-106 \$275.00  
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- Listen to the line or cable
- Communicate with the dispatcher/remote from the base station
- Measure line levels
- Measure tone remote control tone levels
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- Make REPEATERS from mobiles
- POWER DOWN mobiles w/timer
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- Expand Classic 1 to 8 AREAS
- Repackage V/E interconnect in small rack height

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ELECTRONICS  
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Call!  
for catalog  
or quotes



### Answering position handles E911



The "integrated answering position" from Positron serves E911 operators at remote and local public safety answering positions. Its call queuing ensures the first call is first answered.

Circle (377) on Fast Fact Card

### VHF/UHF portables

Tekk's TS-200 VHF and TS-470 UHF 2W, two-channel crystal-controlled portables have machined aluminum controls, neoprene seals and high-impact, ultraviolet-resistant cases.

Circle (353) on Fast Fact Card

### Transmitting electron tubes

Small tetrodes, triodes, twin triodes and pentodes for communications applications are available from Richardson Electronics. What formerly were Philips/Amperex tubes will be made and sold by Richardson under its National brand. During a transition, some tubes that bear the Amperex brand may be delivered.

Circle (340) on Fast Fact Card

### RS-232 card for paging terminals

A quad serial interface card connects as many as four RS-232 entry devices such as video display terminals, personal computers and alphanumeric messaging stations to Zetron paging terminals. Several cards installed in a Zetron terminal support large systems. A typical application is a telephone answering service in which operators type alphanumeric text on video display terminals.

Circle (373) on Fast Fact Card

### Cellular phone mount



SMC Electro-Mount offers the MP 602 Portable Plate portable cellular telephone mount. It fits the Motorola cellular portable and similar phones. It is designed to use with the SMC line of pedestal or flex mounts.

Circle (368) on Fast Fact Card



# STI-CO®

# BROADBAND

STI-CO's custom disguised VHF broadband antennas cover the **entire** frequency range of 150-174 MHz.

Our cellular style VHF broadband covers that range and **also the 806-896 MHz band.**

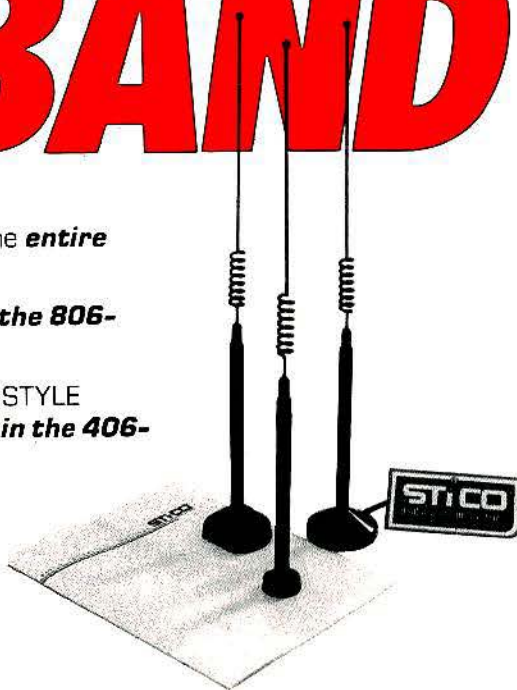
Now, STI-CO proudly introduces CELLULAR ELEVATED FEED STYLE UHF BROADBAND ANTENNAS. **They cover 20 MHz within the 406-512 MHz frequency range!**

More great coverage from STI-CO.

## STI-CO

INDUSTRIES, INC.

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Circle (120) on Fast Fact Card



## Data sheet describes remote status reporter

Lucas Ledex describes the function and electrical and physical specifications of model 2900 remote status reporter in a data sheet. Features include dial-up PSTN status reporting, 12 alarm inputs, one on-board control, battery backup with ac power failure alarm, and automatic test report timer.

Circle (264) on Fast Fact Card

## Brochure describes analog power meter

Model 6950 analog RF power meter from Marconi Instruments is described in a brochure that gives specifications and features. Marconi's complete series of power sensors are detailed in the brochure and are compatible with the 6950. The 6950 includes internal power reference, cable operation and portability with rechargeable battery operation.

Circle (407) on Fast Fact Card

## Catalog explains filters for radio systems

Microwave Filter Company's "RF/88" catalog features medium-power lowpass and high-power lowpass filters for suppression of transmitter harmonics. The lowpass filters can handle 1,400W. For transmitter noise suppression, custom high-power notch filters are available. Diplexers, combining two transmitters or receivers to a common

antenna or two antenna ports to a cable for remote transport, are included. The catalog contains filters ranging from the UHF preselector bandpass filters to combine and interdigital bandpass filters. Specifications, frequency curves, dimension drawings and applications are explained for all units.

Circle (409) on Fast Fact Card

## Licensing guide explains process for business radio

"NABER's Guide to Licensing a Business Radio System" contains instruction for completing FCC Form 574, NABER's supplemental form and FCC Form 572, which is a temporary permit for add-on users to existing community repeaters and end-users of specialized mobile radio systems. The NABER volume includes sample applications for some types of systems.

Circle (480) on Fast Fact Card

## Publication displays telemetering products

Solid State Electronics offers a catalog showing its line of telemetering products which includes voltage controlled oscillators, FM discriminators, amplifiers, pressure transducers and wireless datalinks. The products are recommended for military and industrial application.

Circle (414) on Fast Fact Card

## Instrumentation catalog offers easy references

Condensed specifications grouped by applications for easy reference and comparison are included in a 20-page catalog from Rohde & Schwarz. The booklet details more than 20 instruments suitable for bench and automatic test equipment requirements.

Circle (390) on Fast Fact Card

## Charts, drawings describe grounding equipment

More than 30 charts, illustrations and photographs describe communication grounding and lightning protection equipment in Harger Lightning Protection's catalog. Grounding connectors, jumpers, ground bars, ground rods and transient voltage surge suppressors are among the products detailed.

Circle (478) on Fast Fact Card

## Electronic parts catalog lists more than 11,000 items

The MCM Electronics parts and components catalog contains more than 11,000 items. Test equipment, tools, soldering equipment and connectors are among the items detailed in the publication.

Circle (479) on Fast Fact Card



## 108-1000 MHZ RADIO DIRECTION FINDING



- ★ Interference Location
- ★ Stuck Microphones
- ★ Cable TV Leaks
- ★ ELT Search & Rescue



New Technology (patented) converts any VHF or UHF FM receiver into a sensitive Doppler shift radio direction finder. Simply plug into receiver's antenna and external speaker jacks. Models available with computer interface, synthesized speech, fixed site or mobile - 108 MHz to 1 GHz. Call or write for details.



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## SL-105 SINADDER™ NOW—WITH AUDIO DISTORTION SCALE



True RMS SINAD & 8 range RMS Voltmeter

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FAX: 407/777-1447

TELEX 362837 (HELPER UD)

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INDIALANTIC, FLORIDA 32903 USA

SL-105 \$395

CML-1 with C-message filter for Cellular \$525

Circle (122) on Fast Fact Card



## Readers use classified advertising as reference material

To buy equipment is the No. 1 reason readers turn to the classified ads, according to 73.3% of the respondents to the February "What Do You Think?" questionnaire. But even though equipment selection has the highest ranking, readers do not stop there; they also use the section as a reference for repair, help wanted and other categories as reported in these multiple response statistics:

Refer to classifieds to:	%
Buy equipment	73.3%
Subscribe to service	13.8%
Seek repair	12.1%
Rent tower space	5.2%
See what is available	6.9%
Recommend purchase	2.6%
Other reasons	5.2%
No answer	1.7%

Of the respondents, 76.7% turn to the classified ads every issue, followed by 18.1% that refer to the section almost every issue. No respondents answered that they never turn to the section, and "sometimes" and "seldom" both received a 2.6% response.

More than half of the respondents have purchased products and services in the last year as a result of classified advertisements. Others have used the advertisements to recommend the purchase of products and services and to obtain more information on what is available in the marketplace.

Readers' action taken as a result of classified advertising are reported in these statistics:

Action taken in response to classifieds	%
Purchased products and services	55.2%
Recommended the purchase of products and services	47.4%
Referred the ad to someone else	33.6%
Written or called for additional information	47.4%
Utilized the reader service card to obtain information	62.9%
No answer	4.3%

Readers circle the Fast Fact numbers under classifieds to obtain more information, according to 89.7% of the respondents. "I don't have time to wait 'on hold' for information. Fast Facts will get me basic information for reference," reports a reader. Adds another: "Fast Facts eliminate the need to write companies for more information."

"The Fast Fact is the best part of your magazine," notes a respondent. "Fast Fact is my major source of locating new equipment," concurs another.

Some readers, 10.3%, do not rely on Fast Fact numbers. Instead, many of them contact manufacturers reps directly. "I usually call on the phone to save time," a respondent says.

Many readers regularly turn to the classified section to keep up on positions that are open in the help wanted section. Besides reasons listed on the questionnaire, written responses to using the classifieds include to review equipment from advertisers; see what competitors are up to; keep current with equipment, service, prices; specify equipment; and keep up to date.

**Be sure to answer this month's "What Do You Think?" questionnaire on page 129 and return the card to us so your responses can be used in a future "Feedback" column.**

*What do you think?*

**How do you view the PCP market?**

1. What is your opinion of the PCP market? (Please circle the number that best describes your opinion.)

1. Very good 2. Good 3. Fair 4. Poor 5. Very poor

2. How do you view the PCP market's future? (Please circle the number that best describes your opinion.)

1. Very bright 2. Bright 3. Fair 4. Poor 5. Very poor

3. How do you view the PCP market's present? (Please circle the number that best describes your opinion.)

1. Very good 2. Good 3. Fair 4. Poor 5. Very poor

4. How do you view the PCP market's future? (Please circle the number that best describes your opinion.)

1. Very bright 2. Bright 3. Fair 4. Poor 5. Very poor

5. How do you view the PCP market's present? (Please circle the number that best describes your opinion.)

1. Very good 2. Good 3. Fair 4. Poor 5. Very poor

6. How do you view the PCP market's future? (Please circle the number that best describes your opinion.)

1. Very bright 2. Bright 3. Fair 4. Poor 5. Very poor

7. How do you view the PCP market's present? (Please circle the number that best describes your opinion.)

1. Very good 2. Good 3. Fair 4. Poor 5. Very poor

8. How do you view the PCP market's future? (Please circle the number that best describes your opinion.)

1. Very bright 2. Bright 3. Fair 4. Poor 5. Very poor

9. How do you view the PCP market's present? (Please circle the number that best describes your opinion.)

1. Very good 2. Good 3. Fair 4. Poor 5. Very poor

10. How do you view the PCP market's future? (Please circle the number that best describes your opinion.)

1. Very bright 2. Bright 3. Fair 4. Poor 5. Very poor

11. How do you view the PCP market's present? (Please circle the number that best describes your opinion.)

1. Very good 2. Good 3. Fair 4. Poor 5. Very poor

12. How do you view the PCP market's future? (Please circle the number that best describes your opinion.)

1. Very bright 2. Bright 3. Fair 4. Poor 5. Very poor

13. How do you view the PCP market's present? (Please circle the number that best describes your opinion.)

1. Very good 2. Good 3. Fair 4. Poor 5. Very poor

14. How do you view the PCP market's future? (Please circle the number that best describes your opinion.)

1. Very bright 2. Bright 3. Fair 4. Poor 5. Very poor

15. How do you view the PCP market's present? (Please circle the number that best describes your opinion.)

1. Very good 2. Good 3. Fair 4. Poor 5. Very poor

16. How do you view the PCP market's future? (Please circle the number that best describes your opinion.)

1. Very bright 2. Bright 3. Fair 4. Poor 5. Very poor

17. How do you view the PCP market's present? (Please circle the number that best describes your opinion.)

1. Very good 2. Good 3. Fair 4. Poor 5. Very poor

18. How do you view the PCP market's future? (Please circle the number that best describes your opinion.)

1. Very bright 2. Bright 3. Fair 4. Poor 5. Very poor

19. How do you view the PCP market's present? (Please circle the number that best describes your opinion.)

1. Very good 2. Good 3. Fair 4. Poor 5. Very poor

20. How do you view the PCP market's future? (Please circle the number that best describes your opinion.)

1. Very bright 2. Bright 3. Fair 4. Poor 5. Very poor

## RUGGED RELIABLE RINGO RANGER

Smart buyers know the value of these antennas.

Here are the facts about two of our most popular models:

### CRX-150

4.5 dB gain, 1/2 wave  
146-174MHz  
tunable  
stainless steel  
hardware

### CRX-450B

5.5 dB gain,  
two 5/8 waves  
450-470MHz  
broadband  
stainless steel  
hardware

Ringo Rangers stand the test of time. It's time to call and order!

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## PORTRAIT OF A CHAMPION!!!

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**REDUCE LOST CALLS!!**

**NEWEST PORTABLE ANTENNA**

PATENTED

**FOR VHF or UHF  
HAND HELD RADIOS**

Great for Travel,  
Rental Cars,  
Trucks, etc.

UHF - 3db Gain  
VHF - Unity Gain

Plugs Into Radio

Improves Reception  
on Hand Helds

Clips On and Off Side  
Window in Seconds

Window Rolls  
Up Completely

Whip on Outside -  
Cable on Inside

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MADE IN USA

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## People



Parker



Bartolomeo



Brown



Ardizzone

Changes at Midland LMR, Kansas City, MO:

**Bud Parker** becomes international manager, departing the U.S. State Department Foreign Service as communications and electronics officer.

**George E. Bartolomeo** leaves a government sales position with Motorola C&E, Schaumburg, IL, to become Midland bids and proposal specialist.

**Charles Brown** becomes Midland's north central regional sales manager, leaving a management position with another company.

**Ramon "Ray" Ardizzone**, senior vice president of sales and marketing for Glenayre Electronics, Toronto, joins the board of advisers to the International Mobile Communications Expo and Land Mobile Expo/East trade shows. He retires from the New York Air National Guard and is the recipient of the U.S. Air Force Commendation Medal and the U.S. Air Force Meritorious Service Medal.

Appointments at Bendix/King, Lawrence, KS:

**Roger Farmer** becomes international sales manager, leaving Primus Electronics, Joliet, IL, as divisional vice president.

**Dorinda Carlson** is sales administrator, having left Kustom Electronics, Lenexa, KS, as product market manager.

**John Williams** arrives as regional sales manager, exiting Multiplier Industries as national marketing manager.

Appointments at Lindgren RF Enclosures, Glendale Heights, IL:

**James Kossick** becomes senior electronic technician in research, leaving a manufacturing company as a test equipment designer.

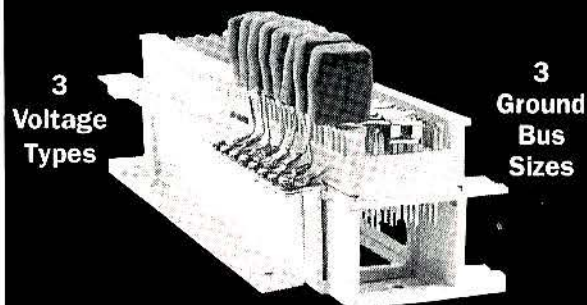
**David Fenn** becomes magnetic shield project engineer in the MRI application engineering group, having left a major medical systems manufacturer in an MRI systems layouts position.

**Bret Watson** brings his shielding background to the company in accepting the district sales manager post for the New England area.

**Ronald A. Duncan** departs Kustom Electronics, Lenexa, KS, as vice president of international sales and vice president of marketing to become vice president of sales and marketing for Avtec, Gilbert, SC. Avtec engineering manager **Gerald Gibson** advances to vice president of engineering.

## 66 Block Protectors ONLY \$275\* per pair

\*Based on 1,820 units. Single unit price \$3<sup>95</sup>/pair.



- Balanced MOV's
- 13 KA/pair max 8/20 surge
- 2 nS response time (1KV/nS)

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Corporation**

OUR 10<sup>TH</sup>  
YEAR

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(702) 782-2511 FAX: (702) 782-4476

Circle (93) on Reply Card





Ferrell



Zaldivar



Voepel



Dinsmore

Changes at Quintron, Quincy, IL: **David D. Ferrell** becomes Quintron's marketing manager for two-way products, after working independently as a consultant.

**Eduardo Zaldivar** begins as sales administrator after obtaining a bachelor's degree from Quincy College, Quincy, IL.

**Rick Voepel** advances from his position as an electronics technician with the Final Test Department to join the company's field service staff.

**Steven Dinsmore** leaves Maxon Electronics, Kansas City, MO, as senior paging technician to join Tekk, Kansas City, as manager of technical services.

**Alan Stewart**, vice president of marketing for Sigtone, relocates to Huntington Beach, CA. He comes from Sigtone's Australian parent company, Signaling Technology. **Benny Moore** is Sigtone's administration manager, having returned from the Australian head office.

**Mal Gurian**, a member of Oki Telecom's board of directors, adds to his responsibility by becoming president of Cellcom Cellular, Clifton, NJ.

Changes at Kustom Electronics, Lenexa, KS:

**Mark D. Greer** exits Bendix/King, Lawrence, KS, as staff engineer to become Kustom project engineer in the digital communications group.

**Dave E. Thomas** leaves ElectroCom Automation, Arlington, TX, as a regional sales manager to become national account manager for Kustom's communications division.

**Rodney A. Houck** becomes Kustom marketing and administrative manager, leaving Colt Technology in Kansas City, MO, as sales and marketing director.

**Jack Pelzman** leaves NEC America, Hawthorne, CA, as advertising and public relations manager to join Yaesu U.S.A., Cerritos, CA, as advertising manager.

**Richard Donley**, product consultant manager with SCE, Hicksville, NY, was presented the company's 1988 Employee of the Year award.

**Dr. Tom Goulding** resigns as director of strategic planning and marketing for Bytex, Southboro, MA, to join Mobile Data International, Richmond, British Columbia, as vice president of marketing.



## THE COMMANDER MULTISWITCH IS THE ANSWER

Whether it's mobile, paging, telephone resale or voice mail, the Commander family of communications terminals can do it ALL. What you might consider to be optional or unavailable in a mobile/paging terminal is typically STANDARD in the Commander.

### Commander DMF-500

A single-channel mobile/paging terminal. 4 DID trunks, 2 End-to-End trunks. 500 subscribers.

### Commander DMF-1500

A 2-channel mobile/paging terminal expandable to 4 channels. 4 DID trunks, 4 End-to-End trunks, 10,000 subscribers.

### Commander DMF-2000

A 4-channel mobile/paging terminal expandable to 6 channels. 4 DID trunks, 4 End-to-End trunks, 10,000 subscribers.

### Commander DMF-3000

An 8-channel mobile/paging terminal expandable to 12 channels. 4 DID trunks, 8 End-to-End trunks, 10,000 subscribers.

### Commander DMF-4000

A 12-channel mobile/paging terminal expandable to 20 channels. The DMF-4000 is the **ultimate** in communications technology. 10,000 subscribers, 8 DID trunks, 12 End-to-End trunks.

All Commander Terminals support Simplex and Duplex IMTS, IPTS, DTMF and 2-tone sequential mobiles. Also 5/6 tone, HSC, 2-tone sequential, Golay and Pocsag, tone, voice and numeric paging formats. Mobile tracking, talkback paging and call forwarding, plus much more.

## ESA

Telecommunications, Inc.

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# NEW MODULAR MOUNTS FROM GAMBER-JOHNSON

Extra heavy construction and your choice of configurations are now available in both StackMaster II and Data-Base!

Choose the base that fits your vehicles and combine it with a mount structure tailored to your communications equipment.

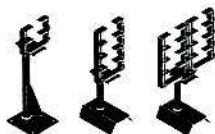


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COMPLETE LITERATURE  
CALL TOLL-FREE



## StackMaster II

Mount 2 to 8 radios, siren/light controllers, etc. in a single or double stack. No dashboard brace is required. Easily converts to a Data-Base when needed.



## DATA-BASE

Mount any North American-made mobile data terminal or laptop, with or without a siren/light controller and/or radio. Includes swivel and tilt with adjustable braking.



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Circle (106) on Fast Fact Card

## Calendar

### September

7-9—Land Mobile Expo/East, Orange County Convention Center/Civic Center, Orlando, FL. Contact: 303-220-0600.

### October

4-7—Telocator 41st Annual Convention and Exposition, Washington Convention Center, Washington, DC. Contact: 202-467-4781.

14-19—International Association of Chiefs of Police Annual Meeting, Commonwealth Convention Center, Louisville, KY. Contact: 301-948-0922.

16-17—American SMR Network Association Fall Meeting, Ritz Carlton Hotel, Rancho Mirage, CA. Contact: 202-331-7773.

### November

1-4—Special Industrial Radio Service Association Annual Meeting, Park Hyatt, Washington, DC. Contact: 703-528-5115.

17—Radio Club of America Annual Meeting and Awards Banquet, New York Athletic Club, New York. Contact: 201-246-7271.

18-20—Communications Marketing Conference, Denver. Contact: CMA secretary-treasurer John Ehret, TPL Communications, 213-256-3000.



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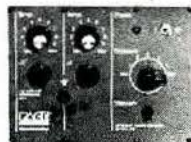
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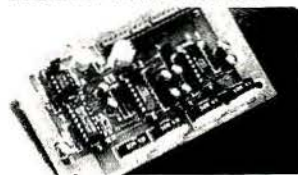
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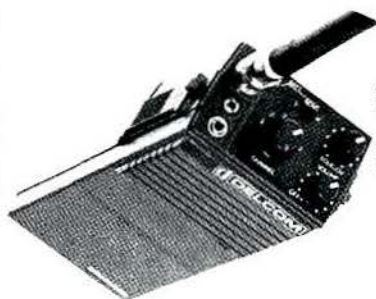
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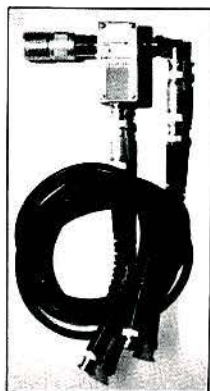
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HP	2545A	TAPE PUNCH COUPLER (AS IS)	\$ 75	HP	620A	SHF SIGNAL GENERATOR	\$ 450
HP	2545B	POWER SUPPLY FOR 2545A	\$ 50	HP	738BR	VOLTMETER CALIBRATOR	\$ 400
HP	312B	SELECTIVE VOLTMETER	\$1,500	HP	766D	DUAL DIR COUPLER	\$ 250
HP	342A	NOISE FIGURE METER	\$ 600	HP	8403A	MODULATOR	\$ 500
HP	3430A	DIGITAL VOLTMETER	\$ 60	HP	8410A	NETWORK ANALYZER	\$1,000
HP	343A	VHF NOISE SOURCE	\$ 100	HP	8731A	PIN MODULATOR	\$ 400
HP	3440A	DIGITAL VOLTMETER	\$ 100	HP	P286A	THERMISTOR MOUNT	\$ 150
HP	3443A	HIGHGAIN DC PLUGIN	\$ 75	KY	30-0/432C	ATTENUATOR	\$ 75
HP	349A	VHF NOISE SOURCE	\$ 150	KY	30-0/432B	ATTENUATOR	\$ 100
HP	355D	VHF ATTENUATOR	\$ 125	MM	AU10A	COAX ATTENUATOR	\$ 50
HP	393A	VAR. ATEN. 500-1000 MHz	\$ 450	ML	AJ-310M	VARIABLE ATTENUATOR	\$ 50
HP	415E	SMR METER	\$ 500	MA	22044	DIR COUPLER 4.0-8.0 GHz	\$ 100
HP	419A	DC MULL VOLTMETER	\$ 350	NA	3000-20	DIR COUPLER .225-.46 GHz	\$ 100
HP	431B	POWER METER	\$ 175	NA	3001-20	DIR COUPLER .45-95 GHz	\$ 100
HP	434A	CALORIMETRIC POWER METER	\$ 350	NA	3004-10	DIR COUPLER 4-10 GHz	\$ 100
				SR	164	POWER METER	\$ 150
				TK	4052	GRAPHICS COMPUTER	\$ 400

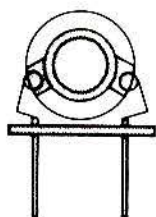
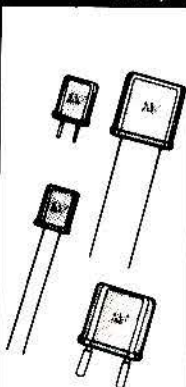
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UNIT PRICE	DESCRIPTION	UNIT PRICE	DESCRIPTION	PRICE
<b>800 MHZ</b>				
Mot "Syntor X", 35w, trunked (T45VBJ5G00) mobile	550	As above, 1-unit, 16 hr (NTN4635)	3750*	NLD6612 1 RF PA 28.00
Mot "Syntor X3", 35w, trunked (T45VJ5G00) mobile	550	As above, 1-unit, 16 hr pocket (NTN4666)	15	NLD6622 1 RF PA 27.50
Mot "Mostar", 35w, trunked (D45TLA5G00) mobile	500	As above, 6-unit, rapid (NTN4668)	295	NLD6623 1 RF PA 27.50
Mot "Mostar", 15w, trunked (D35TLA5G00) mobile	450	"SABER", 1-unit, rapid (NTN4734)	95	NLD6631 RF PA 23.00
Mot "Traxar", 15w, trunked (D35TDA5G00) mobile	400	As above, 6-unit, rapid (NTN4796)	320	NLD6632 RF PA 23.00
Mot "Motrar", 10w, trunked (D25WLA5G00) mobile	250	STX/MX, 1-unit, rapid (NLN8858)	85*	NLD6642 RF PA 30.50
Mot "Syntor X", 10w, trunked (L35VBB5174) base	500	As above, 1-unit, 16 hr (NLN8956)	50	NLD6643 RF PA 30.50
Mot "Mostar/Traxar", trunked no heat sink/P.A., parts radio	75	As above, 6-unit, rapid (NLN8988)	295	NLD6921 BUF AMP 13.50
Mot "STX/MTX", 800 trunked portable as available	call	As above, 6-unit, battery analyzer/conditioner "R" series	400	NLD6942 RF PA 15.50
Mot "Micor", 35w, 5-channel trunked (T45RTA5G00)	300	EXPO, 1-unit, rapid (NLN7175)	60*	NLD6952 RF PA 32.00
Mot "MX350T", 1.5w, 5-channel trunked portable w/DTMF	250	As above, 6-unit, rapid (NLN7177)	295	NLE6931 PRESEL 52.50
Mot "Micor", 35w conventional PL/DPL	350	HT90/HT440, 1-unit rapid (NLN7646)	50	NLE6932 PRESEL 52.50
Mot "Maxar 80", 10w conventional PL/DPL	250	As above, 1-unit, 16 hr (NLN7645)	35	NLE6933 PRESEL 52.50
Mot "MX320", 1.5w conventional, DPL, 2F (H25AAU)	350	As above, 1-unit, 16 hr pocket (NLN7493)	12	NLE6962 PHASE DET 26.50
Mot "Flexar", 10w conventional, DPL, (L35TRK)	325	MT500/HT220, 1-unit, rapid, omni (NLN4569/6897)	75*	NLE6973 UHF XMTR O-ST 42.00
GE "Corona" Marc V trunked, 15w	275	As above, 1-unit, 16 hr, omni (NLN4561/6804)	40	NLE6982 VCO 43.00
STD C666L conventional, 35w, no mic	175	As above, 12-unit, 16 hr, slim (NLN4558)	150	NLE6992 I PA 28.50

<b>450 MHZ</b>				
Mot "Mitrek", 100w, PL/DPL (T74JJA)	500	<b>MOTOROLA PORTABLE RADIO SPEAKER MICS</b>		
Mot "Mitrek", 50w base (L54JJB) local/tone rem., PL/DPL	750			
Mot "Micor", 75w, PL (T54RTA), 2F, talk around	375	MTX800, MTX1000, HT600 (NMN6172) new/used	45/40	NLE8002 RF PA 20.50
Mot "Mocom 70, 75/50/25w, PL (T48BA) w/accy	250/200/150	SABER (NMN6128)	60	NLE8003 RF PA 20.50
Mot "Mostar", 30w, PL/DPL (D44TLA) 1RF	250/300	As above, public safety (NMN6129)	75	NLE8181 RF PA 25.50
Mot "Maxar*50", 20w, DPL (D34JAA) 2F	Special 200	STX, straight, coiled, public safety (NMN6115/4339/6050)	60	NLE8182 1 RF PA 25.50
Mot "Maxar", "Maxar 80", "Maxar*50" also available	call	EXPO (NMN6100)	40	NLE8183 1 RF PA 25.50
Mot Industrial Dispatcher, motorcycle radio, 8w PL, w/accy (D34DCN)	75	HT90/HT440	50	NLE8332 1 RF PA 28.50
Mot "Micor", 75w repeater, 1-user, PL/DPL, duplexer	2500	MT500 coiled/straight (NMN6082/6081)	60	NLE8342 PHASE DET 26.50
Mot "Motrac", 250w base, PCP on 462.925 MHz, PL, tone rem.	1995	HT220, remote/universal (NMN6049/6042)	25	NLE8351 VCO 43.00
GE "Mastr II", 100w, 2F, CG (M75SCCU)	400	NOTE: EXPO, HT600, HT90 mics needing repair are available	15	NLE8352 VCO 43.00
GE "Mastr Pro", 70w, 1F, CG (M75TAU)	100			NLE8353 VCO 43.00
GE "Mastr II", 25w, 12F, CG (E45PPU)	300			NLE8352 RF PA 28.50
GE "Mastr II", 40w, 4F, c/sq (MX56KES)	300			
GE "Mastr II", 40w, 8F, CG (X55KKU) w/w.s. rcvr	350			

<b>150-174 MHZ</b>				
Mot "Mocom 70", 100w, 2F, PL (T73BBA)	400	<b>ACCESSORY ITEMS</b>		
Mot "Mocom 70", 45w, 4F, PL (T43BBA)	250			
Mot "Motrac", 100w, 4F, PL (U73MHT)	160	Mot MAXAR, MOTAR, ac power supply (TPN1136/HPN1007)	95	Midland #70-530B, 450 MHZ, 30W, synth. w/DTMF
Mot "Motrac", 100w, 1F, c/sq (U73MHT) w/o accy	50	Mot MOSTAR desk mic, c/sq/trunked (HMN1005)	20 ea., 3 for 50	dec., 5-pin mic, w/o acc'y 150
Mot "Maxar*50", 25w, 1/2F, PL (D33JAA)	200/225	Mot MICOR base station power supply (TPN096)	300	Redicom #XF742, 450MHZ, 25W, 6F, w/ltd. acc'y 100
Mot "Maxar*50", 10w, 2F, c/sq (D23JAA)	150	Mot MT500 Converta-Comm w/12w audio accy's (N1244)	175	Aerotron "Aerocom 8", 450MHZ, #8DTT25, 25W, PL, w/acc'y, 450MHZ 100
GE "Mastr II", 100w, 4F, CG (MX76KFL)	400	Mot positive ground kit Micor or Motrac	20	Uniden #AMU15K, 450MHZ, 2F, pl, w/acc'y 150
GE "Mastr Pro", 100w, 1F, c/sq (MT76TAS)	100	Mot time out timer kit, Micor or Motrac	15	Mot "Mocom 35", (D43CCN1100), 150MHZ, 15W, w/acc'y—not tested 75
		Mot base station mics, c/sq or PL, Mocom 70, Maxar, Mostar	35/40	Harris #RF1501, 150MHZ, 15W ltd. acc'y 50
		Mot MOSTAR type hang up box, new (HLN4655)	5	Mot "Mostar", 150MHZ, w/o P.A./heatsink, 16F—clean 125
		Mot Micor system 90 DTMF encoder (TLN5837/TTN6006) clearance	20	Standard #C766, 450MHZ, 35W, w/acc'y 200
		Mot Micor system 90 DTMF decoder (TRN6015) clearance	20	Standard #C768, 450MHZ, 15W, w/acc'y 150
		GE "Mastr Pro" base station power supply (EP38 series)	300	Standard #C867, 150MHZ, 35W, w/acc'y 200
		GE "Mastr Pro" transmitter/receiver strips	call	Standard #C666, 800MHZ, CDNV, 30W 150
		GE PE, 1-unit, rapid charger, int. safe (381L1AIX)	60	MOT "Motrac", Console/te base stn. (LHB/MHB series) 100
		GE Mastr II cable kit, 2/8F	40	MOT "PAC, PL", (H14RPPY 3110) 450MHZ, w/micor cables 350
		GE Mastr II control head 1/4F	35/40	
		RCA TAC200, 1F cable, new box of 8	50	
		RCA TAC100, 450 MHZ, 4w portabl w/o batt. as is	50	
		RCA 700/1000 cables or control heads	15	
		RCA TAC100 1-unit rapid charger	50	

<b>42-50 MHZ</b>				
Mot "Mocom 70", 50w, 1F, PL (U51BBN)	150	<b>CLEARANCE RADIOS</b>		
GE "Mastr II", 100w, 1F, CG (MC74AAU)	400			
GE "Exec II", 100w, 4F, PL (U73MHT)	300			
GE "Exec II", 50w, 1F, CG (RT54AAV)	150			
RCA "Tac200", 100w, 1F, QC (MBA19WB11)	150			
AER "M-Pac", 100w, 1F, c/sq (70RR1)	150			
<b>30-36 MHZ</b>				
Mot "Micor", 100w, 1F, c/sq (T71RTN)	350			
Mot "Mocom 70", 100w, 1F, PL/DPL (U61/71BBA)	350			
GE "Mastr II", 100w, 1F, CG (MC74AAU13)	400			
GE "Exec II", 100w, 1F, CG (RT74AAU13)	350			

<b>BASE STATION ACCESSORIES</b>				
Mot deskset, local control 1F/PL (T137D) new/used	90/65	<b>MOTOROLA "MX" SERIES MODULE PULL OUTS—ALL BANDS</b>		
Mot controller, local, series 90, 1F/PL (T1903C) new/used	135/100			
Mot controller, DC remote, series 90, 1F, PL (1882) new	250	MODULE	DESCRIPTION	PRICE
Mot controller, tone remote, series 90, 1/2F, PL/QCII (T1926) new	275	NFD6012	RCVR FIL	\$12.50
Mot controller, DC remote, console, 2F, c/sq (T1601)	300	NFD6022	XMTR FILTER	12.50
Mot controller, tone remote console, PL (T1605)	300	NFD6062	XMTR FILTER	12.50
Mot controller, DC/tone remote console, 2F/4F/8F (T1617)	1000-1200	NFE6001	XMTR FILTER	13.00
Mot phone patch, automatic "Marti" (L1159) 2 prcm	350	NFE6002	XMTR FILTER	13.00
Mot duplexer, 450 MHZ, 4-cavity bandpass (T1507)	300	NFE6022	XMTR FILTER	13.00
Mot duplexer, 450 MHZ, 4-cavity bandpass w/reject (T1504)	325	NFE6042	XMTR FILTER	13.00
Mot QCI paging encoder, 6/36/100/900 call (E08ENC series)	50-400	NFE6052	XMTR FILTER	13.00
		NFN6009	LPFIL	16.50
		NFN6011	ENFIL	18.00
		NFN6012	1 CODE COND	45.00
		NLD6562	RF PREAMP	14.00
		NLD6573	PRESEL	31.00
		NLD6592	PHASE DET	24.00
		NLD6602	VCO	26.50
		NLD6603	VCO	26.50
		NLD6611	1 RF PA	27.00

<b>MOTOROLA PORTABLE RADIO CHARGERS</b>				
MTX 800, MT1000, HT600, P200, 1-unit, rapid (NTN4633)	60*	<b>MISC ACCESSORY ITEMS</b>		
		Mot "Pulsar II", cables (TKN6718)	40	NEW
		Mot "Pulsar II", control head cradle bd (TRN4439)	55	NEW
		Mot "Pulsar II", control head w/hands cord cut	75	
		Mot "PP500/PP100, control head	100	
		Mot "Mostar" type fuse kit assembly—pack of 100	25	NEW
		Mot "Micor/Mocom" speaker cone (#50D8438 No2)	2.50	NEW
		Mot "Micor/Mocom" mic cartridge (59-832726-01)	7	NEW
		Mot "Maxar", 450MHZ, 30W, P.A. (TLE1833)	50	
		Mot "Micor", 120 ac base station power supply (TPN1110)	300	
		Mot "MX", series converta comm charger only (N1244) may need repair	15	
		Uniden heavy duty mobile mic (AMX 105)	15	NEW
		Cushman, comm service monitors, 1-CE/3, 1-CE/5—both have problems	CALL	
		Cushman plug-ins, CE series, 305/306/307/312/317	100	
		Federal, siren w/o speaker (PA 2100)	50	
		RCA cables, TAC 200 series, 1F only, box of 8	60	
		RCA cables, 500/700/1000 series, 1F+4F	25	
		RCA cables, 500/700/1000 series, control heads, 1F, 4F	15	
		Philo, dummy load (Sierra #160B-150 FN)	50	
		Western microwave circulator w/o load, 450MHZ, (3J 450-350)	100	
		Pro Log prom programmer w/extra plug ins (#M980)	375	

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 Mot Micor Base/Repeater L/V/U 450330W CS/PL/DPL from \$995  
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 Mot Mocom 70 Base/Repeater L/V/U 25-100W CS/PL/DPL from \$395  
 1-4Fq from \$395  
 Mot Mitrek Base L/V/U 30-110W CS/CG/DPL 1-8Fq from \$495  
 GE Ex II Base L/V/U 30-60W CS/CG 1-8Fq from \$395  
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 Mot Mocom 70 L/V/U 25-110W CS/PL/DPL 1-4Fq from \$150  
 Mot Micor L/V/U 45-110W PL/DPL/CS 1-12Fq from \$195  
 Mot Mitrek L/V/U 30-110W CS/PL/DPL 1-4Fq from \$295  
 Mot Syntor L/V/U 35-110W CS/PL/DPL 1-99Fq from \$295  
 Mot Moxey/Moxar/80 L/V/U 15-50W CS/PL/DPL 1-4Fq from \$150  
 Mot Pulsar II VHF/MTS/Bell Phone from \$595  
 Mot DC & Tone Remotes from \$100  
 GE Master II L/V/U 40-100W CS/CG 1-8Fq from \$150  
 GE Ex II L/V/U 35-100W CS/CG 1-8Fq from \$150  
 GE MVP L/V/U 5-50W CS/CG 1-4Fq from \$150  
 GE Phoenix V/U 20-45W CS/CG/DCG 2-16Fq from \$195  
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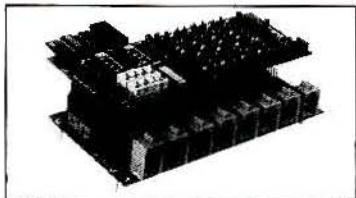
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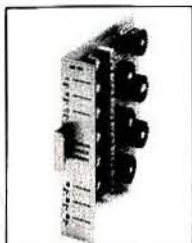


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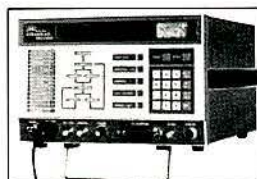
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*Yaesu offers you a choice of dependable Handheld or Mobile-mount radios.*

*For convenience and portability choose the new FTH-2008 VHF or the FTH-7008 UHF Handhelds. Lightweight 15 channel radios with CTCSS encode/decode and IBM PC programmable features.*

*Or choose the FTL-2001 VHF or the FTL-7002 UHF Mobile Transceivers. Compact and reliable 12 channel on-road communications.*

*Yaesu U.S.A., noted for the innovative Dual-band Hand-held VHF/UHF radio, also manufactures base transceivers, repeaters and a full line of communication accessories.*

*For further information on these radios or any of Yaesu's commercial product line call toll-free 1-800-999-2070.*

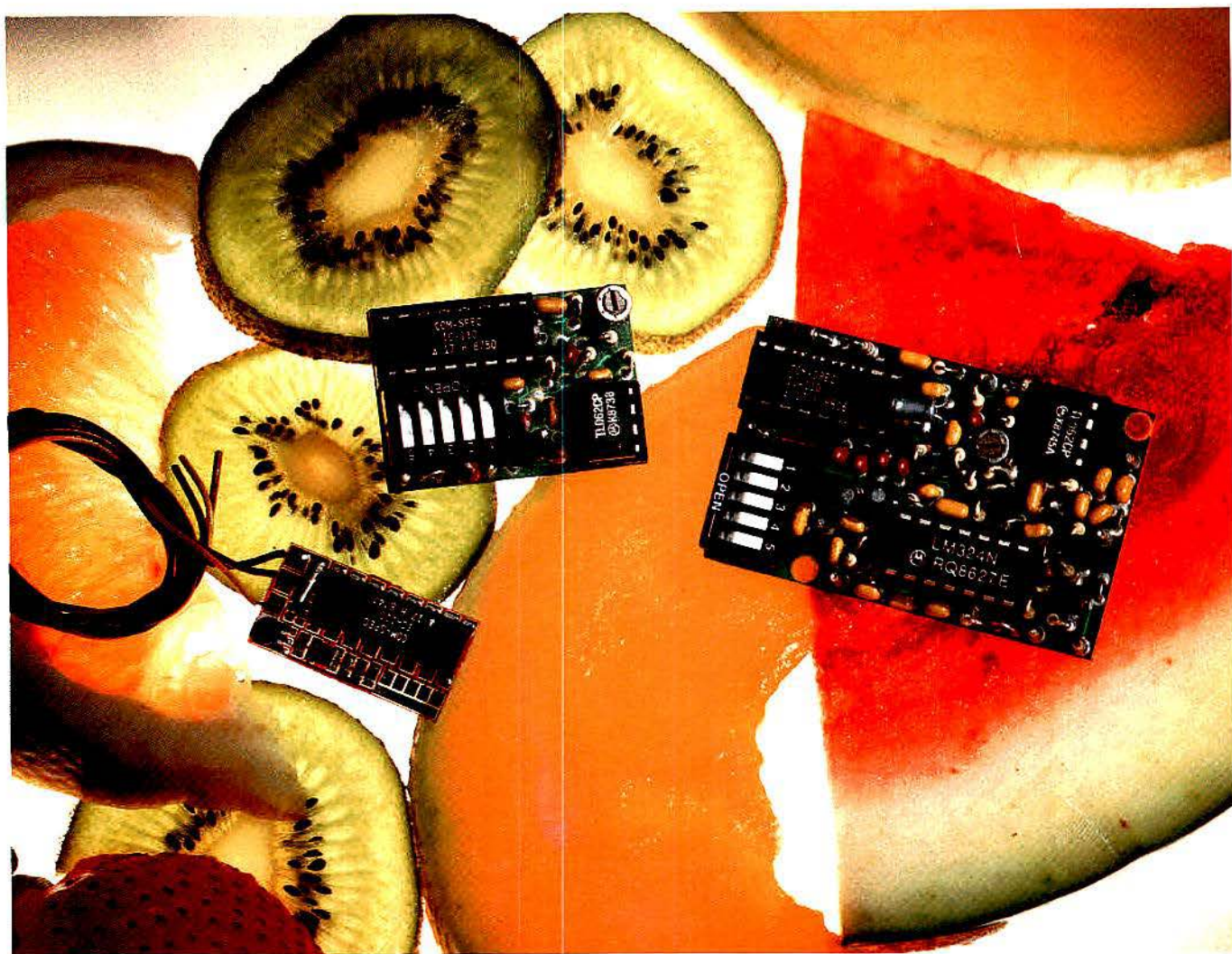


***Yaesu U.S.A. is now offering  
a 2 year warranty on the  
FTL-2001 and FTL-7002 Mobiles.  
Contact your local dealer  
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**YAESU U.S.A.**

Commercial Product Division/Cerritos, California





## Choice Selection.

Now you can have it all! Take all the qualities you've come to depend on in our programmable CTCSS tone equipment: Astonishing Accuracy, Instant Programming, Unequaled Reliability; and add full spectrum tone versatility, multi-tone capability without diodes, a reprogrammable memory... It's our new harvest of CTCSS tone equipment.

The choice is yours! If standard CTCSS EIA tones do not suit your taste, select any 32 tones of your liking from 15.0Hz to 255.0Hz. And if you change your mind, no problem; the memory can be changed in your shop with our HHP-1 programmer, or at our factory for free. Your working tone is accessed by a simple DIP switch, so there's no fussing with counters or other test equipment.

Call today toll-free and find out more about this fresh new flexibility in tone signalling, and don't forget to ask about multi-tone switching without cumbersome diode networks or binary switches.

It's all brought to market by the people who introduce the freshest ideas in tone signalling, and of course our customary same day shipping and one year warranty apply.

**TS-32P CTCSS ENCODER-DECODER** Based on the time proven TS-32, the industry standard for over a decade. The TS-32P gives you the added versatility of a custom, changeable memory base. A low price of \$57.95 makes it an even sweeter deal.

**SS-32P ENCODER** Based on the equally popular SS-32 encoder. Available for CTCSS, or audible burst tones up to 6550.0Hz. Price is \$28.95.

**SS-32SMP SUB-MINIATURE ENCODER** Our smallest encoder for handheld applications. Now you can satisfy that customer that needs to access multiple repeater sites with a radio that has precious little space inside. At \$27.95, the price is small too.

**HHP-1 HANDHELD PROGRAMMER** For programming the 32 memory locations in any of our new programmable products, including our SD-1000 Two-Tone Sequential decoder. The HHP-1 is battery operated for field use, and will program ANY 32 tones from 15.0 to 6550.0Hz in .1Hz. increments. Price is \$199.95.



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